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The International Journal of
Orthodontia, Oral Surgery and Radiography

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VOL. XIII ST. LOUIS, JANUARY, 1927 NO. 1

ORIGINAL ARTICLES

CLINICAL PHOTOGRAPHY FOR ORTHODONTISTS*

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I. ON THE NEED AND VALUE OF PHOTOGRAPHY IN ORTHODONTICS

IT MAY not be amiss to restate some of the reasons photography is widely used in orthodontic practice, the grounds on which this usage may be continued and, as I believe, usefully extended.

It is quite generally conceded that dentofacial deformities are complex, morphologic deviations, which frequently extend beyond the immediate dental boundaries of the human denture. Thus, the alveolar processus and the jaws beyond them, as well as some of the external features of the face, may all be involved in a given case; so that the term *malocclusion* does not adequately express the measure of these anomalies. To provide a rational, scientific treatment for such anomalies we are obliged to make an accurate, differential diagnosis; we must determine the difference between the existing denture of a patient and the condition to be established, before beginning its correction.

The customary, dental plaster casts never reveal extreme deformities of the jaws and face which may exist, and which may seriously affect our prognosis and treatment. Indeed, sundry kinds of deformity, especially if they have been permitted to reach the final stages of their maldevelopment, present extremely difficult problems for orthodontic correction. Hence the phrase *orthodontic limitations* is fast becoming a grim reality. And a simple, intraoral diagnosis, based wholly upon the occlusal relations of the teeth, as disclosed by the customary dental casts, fails us in such instances.

For this reason, many practitioners have sought more effectual guidance in a critical study of the external facial form. Most writers and investigators

*Read before the First International Orthodontic Congress, August 16-23, 1926, New York City.

of importance have recognized this deficiency in our diagnostic procedures, and have emphasized the necessity for their further development. Kingsley, Farrar, Case and Van Loon, to mention only a few, were conscious of this necessity; even Angle, the best exponent of the intraoral method, resorts to a limited use of this concept (e.g., "Class II").

A copy of the facial configuration, either in the form of a plaster cast, or a portrait photograph, has thus become an integral part of every important case history.

Numerous objections to facial plaster casts have been discerned by all who have tried them. Mention may be made of the following: (a) they are unpleasant to the patient; (b) they are difficult to make; (c) they are unnatural in appearance; (d) they are cumbersome to store. (These objections would be invalid if we had no better methods for procuring copies of the facial features.)

Photography presents many advantages as a method for copying those facial features which become our concern in the pursuit of our specialty. Even the youngest children are happy to have their pictures taken and thus cooperate with us. The time required for an exposure, if the office is properly equipped, never exceeds five minutes, because the apparatus is always in readiness. Developing and printing can be taught to an assistant, and the filing and storage of films and prints offer no great difficulties. Prints are certainly more life-like in appearance than facial casts. It also lends itself admirably to uniformity of procedure if artificial light, a standardized background, negative and print-paper are employed.

Photography has, therefore, become a much favored method in recent years. And, if it is properly employed, so that the copies procured of the facial features are true copies, *and accurately related to the dental casts*, it is also the most adequate.

II. THE AVAILABLE METHODS OF PHOTOGRAPHY

1. *Professional portrait photographers* have no competent conception of our needs; their aim is to procure *beautiful* pictures, not *realistic* ones. They have to be taught the purpose of our requirements and they rarely enjoy the experiment.

Many patients present a facial habitus which they consciously, or unconsciously, try to conceal, and which only an orthodontist can analyze. If we employ a professional photographer for this work, it requires our presence during the exposure, if we would procure a true picture of the deformity prior to treatment. This plan consumes a great deal of time and the cost is also greater than necessary. And the occasional objections of the patient (or parent) are more difficult to overcome, if they are requested (during one of their early visits to the office) to visit a public portrait studio.

Again, the seasonal changes in styles, of pose, lighting, size, print-paper and mounting, ultimately lead to a miscellaneous collection of photographs which have little, or no, scientific value. Then the question of ownership of the negatives, and the risk (in case of fire, theft, etc.) conceded by the prac-

titioner, should he decide to deposit them for safe-keeping with the photographer, must not be overlooked.

We do not seek, nor does the patient (or parent) desire, a public use and exhibition of the unfortunate malformation. But photographs of the portrait variety tempt the practitioner to use them as trappings of salesmanship, an undignified, commercial custom, which is in very bad taste, and which should never be employed in private practice.

The diagnostic photographs of an orthodontist need not be beautiful, but they should and can be exact. The equipage of diagnostic procedures in the field of medicine and surgery are not art-objects. A scientific practitioner of dental orthopedics regards his photographs as indispensable instruments for diagnosis and prognosis, and he deliberately refrains from exhibiting them to patients and parents. They cannot possibly understand their scientific value, or comprehend their technical significance. This attitude on our part does not preclude their use for scientific purposes.

2. *Office portraiture and stereoscopic photography* constitute the next step in our utilization of photography. Mass-production of photographic equipment rendered its widespread sale a possibility, if not a necessity.

It is certainly more convenient if the practitioner is equipped to execute the necessary photographic work. It becomes an agreeable diversion to him who, in the love of his vocation, practices his art in accordance with its highest principles. It leads to a routine which seizes the unlimited opportunities for improving his services; it acquaints him with a wealth of material which heretofore passed through his hands unnoticed; nor does it fail to sharpen his critical judgment of the many malformations entrusted to his care. All in all, it is a commendable step forward and exercises a refining influence on his subjective acumen.

But unless the practitioner fully comprehends the scientific purpose and possibilities of photography, he will not achieve the best results; his diagnoses will show no advance over his previous efforts. Most attempts at office portraiture and stereoscopic photography fail to grasp this essential, fundamental requirement of clinical photography. They rarely surpass the rudimentary stages of curiosity. Their employment can only be excused if they will lead to the adoption of a better method; we cannot regard them otherwise than as an elementary training in photographic technic.

3. *Scientific clinical photography* has become a practical possibility in recent years, has been termed *photostatic photography* by Dr. Paul W. Simon, the inventor of the method, and is not a secondary, but necessary, procedure which completes and confirms the diagnosis which is only measurably divulged by the dental casts. It forms an integral part of a *gnathostatic diagnosis*, which is based upon the comprehensive, morphologic principle of the dependent relationships between the teeth and other parts of the head.

Gnathostatic diagnostic methods are but the fulfillment of the vision of the pioneers, the realization of a dream which has "stirred our reason and troubled our minds these many years, the fruition of an ideal to whose lure

of beauty and the call of its truth'' Dr. J. A. W. van Loon, and the late Dr. C. S. Case, of revered memory, gave their fullest measure of devotion.

In a discussion of Dr. Simon's paper: ''On Gnathostatic Diagnosis in Orthodontics,'' before the American Society of Orthodontists, in Kansas City, Mo., March 19, 1924, Dr. L. M. Waugh said: ''Simon's presentation is the first successful effort that has been made by which it is possible for us in a practical way to establish the relationship of the arches, the teeth and the jaws to the cranium as a whole, and in that it stands out as a most important step in advance.''

Most facial reproductions, be they casts or photographs, do not reveal the true nature of the dental deviations with which they are associated; and the dental casts do not show the facial deformities. Hence it is necessary to combine these two methods in such a manner that the true nature of the anomaly, in any given case, is adequately recorded for diagnostic purposes.

The essential advantages of the photostatic method may briefly be enumerated as follows:

(a) The prints are of a very definite size; that is, they are made to an exact scale (usually ¼ natural size). (b) A number of anthropologic points on the patient's face are marked prior to the exposure and these show in the negatives and prints. (c) The median plane of the patient's head and the film in the camera are parallel to each other and always the same distance from each other. (d) They are also vertical to the lens-axis, which is horizontal and on the same line as the orbital points of the patient. (e) In other words, uniform conditions are provided for all patients, and for all pictures of the same patient, taken on different days. (f) Pictures procured under these conditions permit the taking of measurements on them; they possess a unique and desirable metric value. (g) The negatives of a patient taken before and after treatment may thus be placed on each other over an illuminated field, properly orientated by their visible landmarks (the anthropologic points) and compared.

III. PHOTOGRAPHIC EQUIPMENT AND TECHNICAL DETAILS

A floor space measuring 5 x 10 feet will provide ample, even generous, working space for a photostatic equipment. The dark end of a room, laboratory, or hallway, will serve our purpose because artificial light is used. The apparatus should be kept in readiness at all times, like a Roentgen-ray equipment. There is one important difference to be noted in their use: in radiography the apparatus is adjusted to the patient, whereas in photostatics the patient is moved towards the apparatus, the latter remaining approximately stationary.

The camera is of a box type (Fig. 1) and, after it is adjusted for use, the ''bellows'' remains fixed. It is mounted on a stand of studio-pattern, which provides the necessary stability. It is also provided with a beam to which a nose-board is attached. The latter is accurately fixed in position with the aid of a ''median'' scale 4 cm. long, and two half-round red discs. This nose-board renders possible the accurate posing of the patient's head, an indis-

pensable requirement. The camera, beam and nose-board may be adjusted to any required height, varying with the age and stature of our patients.

The lens is of the portrait-type, with double objective and *long focal distance* (25 cm., approximately 10 inches).

A light, simple dining chair, provided with ball-bearing casters, so that it may be pushed about without difficulty, should be used for seating the patient. A headrest can be attached to this chair and after the patient is seated and the headrest is adjusted, they are moved towards the nose-board on the beam.

A 100 to 300 candle-power electric light, mounted on an adjustable stand, or suspended from the ceiling or adjacent wall, provided with a reflector and a piece of "frosted" glass to relieve the glare, is ample for lighting purposes.

A yard or two of black felt cloth, dropped in window shade fashion against the adjacent wall, about two or three feet behind the patient's head, forms the best background and provides the necessary "atmosphere." Such a dark, one-tone background, without ornamentation, is best.

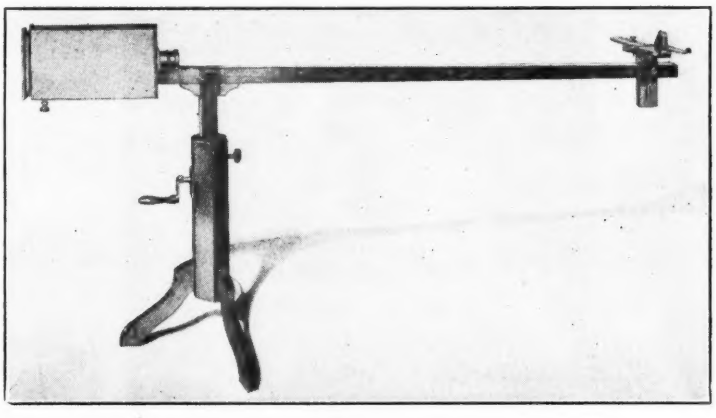

Fig. 1.

A compact, well arranged and easily accessible dark-room forms a desirable part of the equipment, though it is not absolutely essential.

Since an image ¼ natural size is adequate for diagnostic purposes, "Kodak" film-packs, 3¼ x 4¼ inches, one dozen exposures to the pack, may be employed for the negatives, which obviates retirement to the dark-room between exposures. These will yield prints 6 x 9 cm. in size, after trimming. For life- or natural-size work, Eastman's "superspeed" portrait films, measuring 8 x 10 inches, are employed.

Pyro developing solutions, prepared and used according to the manufacturer's formulae, and chrome alum fixing bath give the best results in negative development.

Various kinds of print-paper, in many weights and speeds, have been tested, but "Azo," F 4 gloss, single weight, is our paper of first choice. If this is squeegeed on plate glass while wet, a perfectly flat, smooth, glossy print is procured, which brings out the details and enhances its value for half-tone reproductions. Linen backs may be applied before removal from the glass plates, and since squeegee glossy papers are usually single weight stock, this

method promotes their durability. (Linen-back material can be procured at photographic supply depots.) If a matt-surface finish is desired, a double weight, matt paper should be used. This type of finish reduces the time and labor required and permits the drawing of diagnostic lines in lead pencil. This latter method is adequate in our daily work, but not suitable for prints for publication. Of course, the kind of paper used depends on the quality of the negative and, to some extent, on the subsequent use of the prints.

"Before using the apparatus, the orbital edge of the nose-board must be placed in the lens-axis. To do this, we proceed as follows: the ground glass is removed from the camera and with a ruler and a sharp lead pencil we draw two diagonal lines on its inner (matt) surface. Their point of intersection will lie in the lens-axis [because the lens is accurately placed in the lens-board and the latter is immovable]. The ground glass is again inserted in the camera, the light is thrown on the scale, or nose-aimer, and the bellows

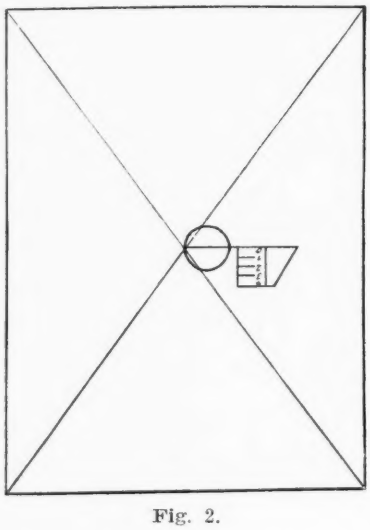

Fig. 2.

is moved back and forth until a sharp image of the scale on the nose-aimer is procured. The nose-board is still in temporary position, however; but very little effort is now required to bring it into exact place, because it can be moved and turned in any required direction. The adjustment is finally concluded when the image of the half-round red discs forms a complete circle and the outer end of their horizontal diameter (that is, the line of union of the two discs) lies in the center, or point of intersection, of the diagonals of the ground glass (Fig. 2).

"The bellows of the camera is then adjusted until the image of the 4 cm. 'median' scale is sharp and measures 1 cm. in length, after which all screws are securely fastened. The apparatus is now ready for use and a glance at the image of the red discs will always disclose whether any alterations occurred between the various appointments." (Simon.)

But prior to seating the patient, it is always well to turn on the light, glance at the image of the "median" scale and discs, to note if they have been tampered with, insert the plate-holder, cover the lens, remove the safety-slide

from the film pack and exclude any unnecessary glaring daylight by drawing the window shades. A trained assistant can do all of this while the practitioner is preparing the patient in the chair.

In my own work, I have found it convenient to make a special appointment for taking gnathostatic impressions of the teeth and photostatic exposures for the photographs. Both procedures require marking of the following points on the face: the two orbitalia, the two tragia and the left gonion (Fig. 3). These points are best located with the aid of a dermatrograph (a lead pencil used by dermatologists) and subsequently these are more visibly marked with small pieces of black adhesive paper, about 2 mm. square. (The binding strips used on lantern slides are suitable for this purpose and can be

Fig. 3.

procured at optical depots.) After these are in position, it is advisable to take the picture and follow this with the impressions, because the latter may cause disturbance of the facial muscles.

Thus, after all is in readiness, the operator takes his patient to the photographic apparatus, adjusts the headrest and pushes the patient and chair towards the nose-board, until they are very close to each other. The height of the board is then adjusted by raising or lowering the camera. The operator then steps in front of the patient and sights the aimer, so that the median plane of the head is in proper alignment; then gently draws the patient towards him until both orbitalia (eye-points) touch the orbital edge of the nose-board. The board is then turned back on its hinge and the patient is instructed not to move. With children of a nervous temperament, the assistant may be required to hold the patient's head firmly in position. The assist-

ant's hand should be so placed that it will not show in the picture. Fortunately, this is seldom necessary. In females, the long hair must be arranged behind the left ear, so that the tragion is exposed to view. An exposure of two seconds, by removing the lens-cap, will usually suffice. A little practice with the particular light employed, will soon establish the correct time requirement.

The orbital points mentioned above are cephalometric points (points on the head of the living subject) and are not identical with the craniometric points used by craniologists. The left orbital and ear-points, as well as the left gonion, will show in the negative and on prints made therefrom. (Fig. 4.)

Fig. 4.

Full front views may also be taken with a photostatic camera, but they are not essential for differentiating sagittal deviations, due to jaw deformities. Gnathostatic casts show the relations of the denture to the median plane; and direct measurements like the bi-zygomatic and bi-gonial width may be taken with calipers to substantiate, or complete, our conclusions regarding this relationship. Waldron has recently attached an extra nose-board to the beam (at right angles to the one used for profile prints) and inserted a hinge-joint in the beam, which permits an easy removal of both nose-boards at the moment of exposure.

After the negatives are finished, they are placed on an illuminated field (such as we use for the study of radiographs) and the points may be connected by drawing sharp lines with a penknife, marking the orbital and horizontal planes. Lines can also be drawn from the gonion to the gnathion,

and from the gonion to the tragion, and the mandibular angle and the relative length of the mandibular body and ramus can thus be demonstrated. Of course, these are only approximations; but since they are always drawn in the same exact way, they are sufficiently accurate and the best available means for diagnostic purposes.

The required photostatic portion of a diagnosis can thus be completed on the negative, or film, but most practitioners will prefer prints for this purpose. To properly standardize the photographic prints, we place the films on the illuminated field and cover them with a standardized transparent pattern of celluloid (Fig. 5). For ¼ natural size negatives this pattern should

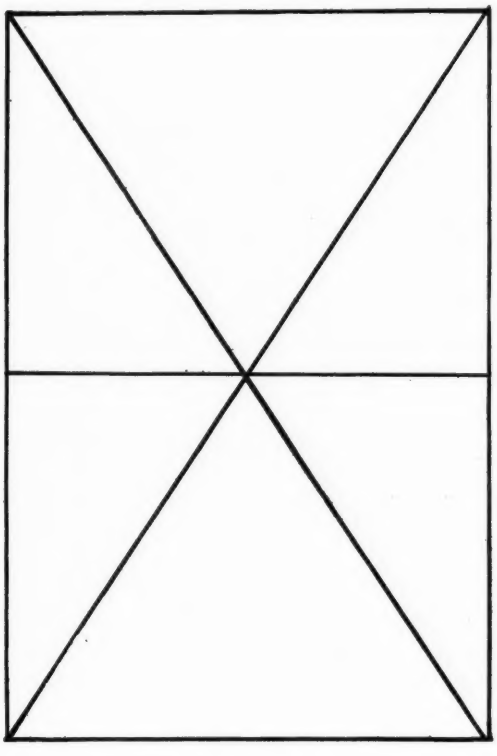

Fig. 5.

measure 6 x 9 cm.; for ½ size negatives 10 x 15 cm.; for natural-size negatives 16 x 22 cm. These patterns have a horizontal and two diagonal lines etched into them to facilitate their proper placement, and their margins form exact right angles. Printing matts are cut out to the same respective sizes and accurately placed on the marks previously scratched on the negatives, or films, with the aid of these transparent patterns. Prints of uniform size are thus procured and their left margin is always perpendicular to the horizontal plane of the patient's head. This minor detail is a practical advantage in any cursory examination of a photostatic photograph.

The photographic films, prints, drawings of the curves, written diagnosis and history chart, etc., can all be filed in one envelope, bearing the patient's name and case number, which is a great convenience.

An index should be kept of all negatives, prints, etc., and their numbers recorded on the record sheet.

"Photographs are perspective, not geometric, projections; they originate from rays which cross each other in the center of the lens. This fact may be regarded as an objection to the metric value of photographic reproductions, because the various points and individual parts of an object are thus projected with varying degrees of angularity; those farthest removed from the lens appear smaller, whereas points nearer the lens appear larger. But this error diminishes with increasing distance between object and objective."

Simon devised a unique experiment for computing this error in a perspective reproduction, to show that within certain bounds it is of no consequence in our work. He also reminds us that an orthogonal, or geometric projection of a profile does not yield a more accurate presentation of the

Fig. 6-*A*.

Fig. 7-*A*.

depth of an object like the human head. In other words, in a geometric projection of a human profile one cannot determine the natural distance between the gonion and the median plane. Computations in the third dimension are thus excluded in either method.

"The photographic method, therefore, occupies first place, in so far as accuracy of reproduction is concerned. Martin expresses himself as follows: 'Only such measurements yield useful results as can be applied uniformly by observers after preliminary training; and experience has taught us that we must relinquish as little as possible to personal initiative and interpretation.' Photostatic reproductions offer the best available method for attempting an appraisal of the living face."

"It is advisable for a beginner to make two photostatic negatives of the same individual within a week of each other, so that appreciable changes in the growth of the face cannot occur between them. These negatives are then

accurately marked and when placed over each other in the illuminated field their respective points, straight and curved lines, should be in perfect continuity.''

IV. CLINICAL PHOTOGRAPHY AS A DIAGNOSTIC AID

Since the introduction of gnathostatic methods of diagnosis, it has been said that the gnathostatic dental casts are clumsy and inartistic, and that the photostatic facial photographs should be larger. The fact remains they are accurate and scientifically adequate and reliable. There can be no objection to the taking of larger pictures and additional impressions for casts, as has

Fig. 6-*B*.

Fig. 7-*B*.

heretofore been the custom; but the practitioner who will give the new methods a fair trial, will soon be convinced of their value.

The differential diagnosis of a dental anomaly involving the facial lines can be completed in a very satisfactory manner with the aid of gnathostatic casts and photostatic photographs, and the metric methods which are applicable to them.

In Figs. 6-*a* and 7-*a* gnathostatic casts are shown of two cases that could be classed as bilateral distoclusions, or ''Class II,'' cases. The distal relation of the mandibular arches to their maxillary arches is clearly shown. The orbital plane passes through the maxillary canines in the left side of each arch; but the mandibular arch in Fig. 6-*a* is more posterior to the orbital plane than in Fig. 7-*a* and the roots of all the mandibular teeth in Fig. 6-*a* are inclined to posterior.

Let us now examine the photostatic prints (Figs. 6-*b* and 7-*b*). In 6-*b* we note that the gnathion does not lie in the orbital plane and that the entire mandible is in *retraction* (total mandibular retraction); the distoclusion is merely a symptom. In 7-*b* the gnathion lies in the orbital plane, as do the cheilion and maxillary canine. But the entire mandibular arch is posterior on its base and we thus conclude that a *dental + alveolar retraction* exists, with the mandibular substratum anatomically correct.

In Fig. 6-*a* and *b* the treatment should aim for a complete mandibular development. In Fig. 7-*a* and *b* a frontal movement of the lower dental arch only is indicated.

Many cases might easily be introduced to show the very great value of gnathostatic diagnostic methods, time permitting; but for an elaborate presentation you are referred to the works of Dr. Simon, translations of which are now available.

ORTHODONTIA IN ITS RELATIONSHIPS TO GROWTH AND REPAIR*

By R. C. Derivaux, M.D., Nashville, Tenn.

MEDICINE and surgery, together with their included specialized fields of study, have witnessed many changes during their evolution, not the least significant of which has been a profound alteration of viewpoint with reference to the influence of biologic phenomena. Consideration of this influence has gradually assumed an increasingly far-reaching application which is being shared in orthodontia to at least as great a degree as in other fields.

The history of the relationship of biologic principles to affairs of medicine is the history of the beginnings and development of natural philosophy itself. It may be traced in an unbroken line to the earliest records of human scientific thought which, when read in the light of present day knowledge, often allow the light of truth to shine forth with startling clarity. Witness, for example the description of the nature of the animal organization as depicted in the writings of Aristotle:[1]

"The animal organism must be considered after the similitude of a well organized commonwealth. When order is once established in it, there is no more need of a separate monarch to preside over each separate task. The individuals each play their assigned part as it is ordered, and one thing follows another in its accustomed order. So in animals there is the same orderliness, nature taking the place of custom, and each part doing his own work as nature has composed them. There is no need of a soul in each part, but she resided in a kind of a central governing place in the body, and the remaining parts live by continuity of natural structure and play the parts nature would have them play."

Reiteration and development of this conception have been largely the sphere of physiology and its accessory sciences into present times.

It is the purpose of the present essay to discuss certain of the basic biologic phenomena concerned with the growth and repair and to consider their application in their relationships to orthodontia. I, being neither biologist nor orthodontist, recognize my manifest limitations and freely acknowledge my inadequacies on this topic from either viewpoint; but as students of medicine and dentistry in whatever more highly specialized fields, physicians, dentists and biologists are confronted with fundamentally common problems, it is this community of scientific interests that invokes justification. If I may have succeeded in emphasizing some of the biologic ground-work related to the field of orthodontia and furthering its clinical consideration I feel that the present effort will have been more than repaid.

*Read before the First International Orthodontic Congress, August 16-23, 1926, New York City.

THE AIMS OF ORTHODONTIA

Orthodontia, as a field of applied endeavor, is concerned with the prevention and alleviation of dental malocclusion; in more comprehensive terms, it has as its object the "prevention and correction of conditions of malocclusion of the teeth that interfere with the normal functional activities of the several structures that make up the masticatory apparatus."[2] It might be added that these things are to be accomplished with very clear ideas in mind of the exact limitations of the criteria as to normality, both as to the individual and his occlusion; with a very clear understanding that the conception and scope of orthodontia are to be carried far beyond the teeth and the arches if anything substantial is to be accomplished; and finally with a clear understanding that the corrective effort must be applied in harmony with biologic laws and tendencies as well as sound mechanical principles. These generalizations are admittedly commonplace but they are nevertheless indispensable to a broad and inclusive point of view.

The fact is becoming more widely appreciated that the term "normal," if employed without qualification or limitation, is of questionable utility. If one is inclined to regard normality as connoting a theoretical state of biologic perfection of structure and function, there is risk of grave error. It is far more satisfactory, as well as accurate, to regard "normal" and "average" as practically synonymous expressions, and conformable to the provable facts of variability to recall to mind that every individual of the human or any other species differs in every particular, both structural and functional, from every other animal; how nearly the hypothetical ideal of perfection may be approached is possible of reasonably accurate determination and numerical expression by simple statistical investigations; for the purposes of orthodontia this has been undertaken by Hellman[3] in an important research and his method of investigation, as based upon his concept of occlusion and its evaluation, as well as his conclusions as to normality and allowable variations, are of the greatest value. Johnson[2] questions the right of Hellman to draw far-reaching conclusions and derive general statements based upon the examination of a relatively small number of individuals (69); in this he is undoubtedly correct, as the possibilities of error in random sampling are relatively enormous as long as the mass examined is small in proportion to the whole; Hellman's work has, however, a basic importance, and, as Johnson suggests, should be extended on a large scale. Northcroft[4] discusses normality from much the same standpoint and his findings emphasize the relationships between the deciduous and permanent dentitions and growth-rate in their bearing on orthodontic end-results.

For the purposes of applied orthodontia, it is the principles of typical development which have importance; they direct the individual consideration of each case in point as a separate problem and the achievement of satisfactory functional relationships, often enough a compromise doubtless, in harmony with the organism as a whole as the real aim.

GROWTH AND REPAIR

Of the origins of life and of its nature in its first causes, science offers no explanation. There is no dearth of knowledge of the manifestations of life on the bases of chemical or physical activity but the limits of these are attained in accounting for what occurs only to leave the question of why as complete an enigma as in centuries past. Of the essential properties of living substance or tissue, that of growth is usually enumerated together with those of assimilation, dissimilation, reproduction and irritability. In its complete meaning, the term "growth" is usually held to include cell differentiation, and in its final sense it includes also development. Growth is principally a function or characteristic of youth; it embodies not only quantitative but qualitative changes in the mass of living substance, and is a biologic fundamental that is basically related to not only the physiologic phenomena of normal procedures but equally essentially to the processes of repair, regeneration and tumor formation.

Residual within the cell, the ultimate constituent structural unit of living substance, is the capacity for reproduction and growth; in these are concerned several primary factors which include what for lack of better understanding must be referred to for the present as the "growth impulse" or "vital" factor. Of this, nothing is known save the fact of its presence and this distinguishes the living cell from the dead; it is nothing less than life itself. The nutrition factor or metabolism factor is well understood; certain indispensable "raw materials" in the form of water, air, proteins, carbohydrates, fats and mineral substances are required and more or less permanently incorporated and retained during the constructive processes of growth; in adult life, the katabolic or destructive processes and the anabolic or constructive are in approximate equilibrium and replacement takes the place of incorporation, while in declining life or senescence, there is not only but little growth but material wastage as destructive changes gain ascendency over the constructive.

Growth and nutrition are governed and controlled by certain accessory nutritional factors (vitamines), by hormones, and by the nervous apparatus. It may be interfered with, diminished or arrested by derangement or interference with the factors mentioned, as well as by infections (intoxications) and physical disturbances,—including mechanical pressure. It may be fostered, theoretically at least, by withdrawal or interference with the normal restraining mechanisms (disturbance of functional equilibrium) and by maintaining functional activity at an extreme height (muscle development), but as a matter of fact, while there is plentiful evidence that active and direct stimuli to tissue growth exist, very little is understood of their nature and the mechanism of their action.

Finally, the aggregate of the processes of growth and development are under the influence of the factors concerned in heredity, incorporated with the chromasomes, by which are governed the rate and inequalities of growth and the preservation of the characteristics specific to the tissue, the individual and the species is insured.

Repair is an adaptation of the organism to unusual conditions with reference ordinarily to injury. It differs from inflammation in this latter in the nature of an immediate tissue reaction and an attempt and often beginning repair, while repair proper is an appropriate response to disturbance which impairs the functional integrity of a tissue. It is intimately related to the process of normal growth on the one hand, and to those of regeneration on the other; standing as it does midway between these two processes, it partakes of the characters of both. The tendency of repair, as a biologic process, is that of restriction of lost substance.

It is one of the generalizations of biology that the lower and simpler the form of life, the greater the capacity for repair and regeneration; likewise that the younger the individual, the greater also the capacity for regeneration. Unlike such examples as Hydra which is able to survive extensive mutilations and ultimately regenerate itself into several new individuals, and the earthworm which is capable of supplying itself with a new head or tail segment as needed, adult man is without all but a small vestige of power for regeneration, although it is stated that something of this power is present in the embryo up to a certain point of development. As stated by MacCallum[5] "the fertilized ovum and the first segmentation spheres are totipotent; that the cells produced in the course of later segmentations are multipotent, but the cells of the differentiated tissues are highly specialized as a rule and potent to produce others of the same type only. Quantitatively also the power of regeneration diminishes the advancement of development and cell specificity, but even in the mature human individual the latent powers of these specialized cells for regeneration is often astonishing."

Among the mature tissues, epithelium and the several connective tissues possess the greatest and most versatile capacities for regeneration, while in nervous tissue, as represented ultimately by the whole neuron or its cell body, the opposite status is reached and no regeneration takes place whatever. In glandular organs and in the muscle tissues, capacity for regeneration is quite limited; in these there is evidence to indicate unmistakable regenerative effort among their specific cells, though the *functional* importance of the regenerated material is probably but slight; *structural* restoration is made practically invariably by the connective tissues.

The healing of wounds depends upon the operation of the principles of growth, repair and regeneration, varying only in details as to the nature and degree of injury and the particular tissues involved.

Bone presents aspects of especial importance in orthodontia inasmuch as it is the tissue upon the manipulation of which the applied effort of its corrective procedures are largely centered. Bone is a plastic cellular tissue whose principal characteristic is its calcium containing intercellular substance or matrix. It is developed relatively late in embryonic life, either directly by calcification of the fibrous intercellular substance (membranous or membraniform bone), or indirectly and through an intermediate stage of cartilage (cartilagenous or chondriform bone). The essential cells concerned in the growth of new bone and in regeneration are the osteoblasts, considered by

some authorities as the source from which the calcified matrix of bone emanates as an exoplasm. As bone grows, occasional osteoblasts become enclosed in lacunae and remain as bone cells, now no longer active in bone production except under special circumstances when interstitial growth, so-called, may occur. In the long bones, the osteoblasts of the periosteum and of the endosteum are responsible for such accretionary growth and changes in the bony architecture as is determined by functional, endocrine and other features; these latter are admirably presented in the writings of Jansen[6] who has contributed extensively to present knowledge of bone physiology.

Repair in bone and its regeneration after injury are accomplished by mechanisms identical with those involved in its first development. The cells principally concerned are osteoblastic in function; a temporary connective tissue structure is first laid down, vascularization occurs, differentiation into an osteoid structure follows, to be finally calcified and consolidated as true bone.

Bone reacts to extrinsic factors and agencies and its response is as direct and definite as in less dense structures, though it is possible that such reaction may be long in manifesting itself because of the greater density and resistance which are characteristic of bone. Nutritive influences, and adequacy of calcium and other essential inorganic constituents, certain endocrine factors, notably pituitary, thyroid, parathyroid and possibly thymus derivatives, functional harmony and satisfactory innervation are among the basal necessities of osseous well-being; the interference with or absence of any of these is not long in demonstrating its influence. Atrophy of bone has been studied by Allison and Brooks[7] from the viewpoint of nonuse and found from their experimental studies that the process of bone atrophy affected the size, shape, thickness, length, weight and texture of the whole bone, but that the chemical composition, the physical characteristics and the regeneration of bone were not affected; the changes are *quantitative* rather than *qualitative.*

Pressure as a factor in the production of response in bone is worthy of especial consideration. Examples are numerous in pathology as well as in biologic sciences of the effects of pressure on living or on growing organisms. Pressure anemia due to tight bandages or by the weight of the body on the bed is soon followed by local death of tissues (decubitus or bed-sores); grooving of the liver due to corsets, the flattened heads of certain Indian tribes, the deformed feet of Chinese women, etc., are examples of the results of slighter pressures more or less continuously applied; atrophy of tissues compressed by tumor growth is well known and is particularly conspicuous in the case of bone which may be completely destroyed. The mechanism of these phenomena is complex but is definitely inclusive of the factors of continuous interference with cellular metabolism by direct compression, by interference with afferent blood supply and with efferent waste product drainage. Where pressure on the other hand is *intermittently* applied, the results are quite the reverse and instead of acting as a destructive influence, its function is stimulative and is productive of growth, and at times of overgrowth and of callus. The application of these principles to orthodontia is obvious and mer-

its consideration when mechanical forces are being brought to bear on living tissues. It should also be remembered that it is extremely difficult to accurately estimate in advance the end-results of disturbance of functional tissue equilibria in any manner and that it cannot be regarded as exclusively an affair of purely mechanical interactions.

The logical use of mechanical forces in orthodontia would seem to depend on a gradual adaptation of the stimulating factors to the needs of the particular problem as a whole. The sequence of events incidental to the actual movement of teeth and the importance of accurate estimation of degree of force in relation to the time factor are summarized by Oliver[8] as follows: "Without going into the minute histologic changes which occur when teeth are changed in position and relationship by orthodontic management, it is important to bear in mind that such changes are accomplished in accordance with well established laws of growth, repair and inflammation. They are determined through the agency of cell activity produced in consequence of mechanical stimulation applied usually in the direction in which it is desired that movement take place. Pressure applied behind a given tooth is exerted through the tooth, and inasmuch as the tooth itself is an unyielding body, the pressure applied is transmitted through the tooth and against the enveloping tissues. Here bone destruction is accomplished, probably through the agency of osteoclasts, the tooth moving steadily forward as the tissues before it are removed. Bone deposition or replacement takes place behind the advancing tooth with the result that, if the degree of pressure applied and the time factor are properly adjusted, the process is uniform, free from accessory disturbances such as inflammatory reaction, etc., and the desired result accomplished. The degree of force applied is of the utmost importance. If excessive, it is traumatic and produces an inflammatory reaction of varying degree; if inadequate, it is followed by no results whatever; if of exactly the proper degree, that is, subtraumatic, tooth movement without inflammation and without impairment of fixation is accomplished."

Orthodontia is still in its developmental phase. Like its kindred fields of applied biologic endeavor, its wealth of knowledge is being added to by accretions from research, from clinical observation and from extensions in the allied sciences. Much however is already known and is accessible for incorporation into practical usage. Originally an outgrowth and a development of the purely mechanical aspect of prosthetic dentistry, orthodontia has gone forward and taken its larger place in its consideration of not only the dental equipment and its adjacent structures, but more recently, of the individual and the totality of his physical prosperity as a whole. The place then of a biologic viewpoint is fundamental and the influence of the natural physiologic tendencies of growth, development, repair, reaction to injury, etc., in their manifold aspects, constitute a groundwork from which it would seem that orthodontic enterprise should logically begin.

With the highly important technical and mechanical phases of orthodontia, the present essay is not concerned. If it has succeeded in bringing forward certain of the more important biologic fundamentals of growth and the

process of repair, and has indicated something of their clinical utility, its purpose will have well been served.

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DISCUSSION

Dr. Martin Dewey.—During the past few years we have had many papers dealing with biologic problems as related to orthodontia. In fact, some have gone so far as to coin the term "biologic orthodontia" which would lead us to believe that something new had been brought into the practice of orthodontics. Orthodontia might be defined as a mechanical interpretation of a biologic problem. Every case of malocclusion is the result of some abnormal development, and as biologic sciences deal primarily with growth and development, you can very readily appreciate what is meant by the term suggested. However, it is not my intention to write a new paper as I was assigned to discuss a paper entitled "Orthodontia and Its Relationship to Growth and Repair." The main part of the paper is a review of general biologic facts with which we heartily agree.

Orthodontic treatment is necessarily closely related to growth and repair of osseous structures. However, it is our belief that the latter part of the statement which refers to repair should to a certain extent, be modified or entirely dropped. Repair necessarily implies something has occurred which makes a repair necessary. In other words, before any object can be repaired it necessarily must be injured. Orthodontic treatment should not be carried to the extent of producing an injury. Therefore, no repair should be necessary. The most important biologic principle involved in the practice of orthodontics is found in the statement that bone develops as a result of mechanical stimulation. It is the mechanical stimulation derived from the orthodontic appliances which should produce the growth of bone. If we believe in the above statement, orthodontia has great possibilities in producing osseous developments. However, in times past we have found a number of men who talk a great deal about biologic developments and biologic laws in relation to orthodontia, but as soon as they begin to consider orthodontic treatment, they seem to forget everything they have said about biology. We find men contending that bone cannot develop as a result of orthodontic treatment and that any change which occurs must necessarily be limited to the small osseous structure known as the alveolar process. Bone is a calcified connective tissue which responds to mechanical stimulation regardless of whether that stimulation is a result of function or a regulating appliance. Therefore, the ideal orthodontic treatment is a stimulation along functional lines and the ideal regulating appliance is one which will not interfere with functional activities. It has been demonstrated clinically and experimentally that it is possible to produce the growth of both mandible and maxillae. The manner of producing this growth, however, is misunderstood by some men because the growth of bone is misunderstood. Bone may be considered as a plastic material which responds to mechanical stimulation, and this response is brought about by a constant change produced by absorption and rebuilding. The question of interstitial growth of bone is misunderstood by a great many men because they do not realize that it is possible for bone to change as a result of functional absorption and rebuilding.

The osteoblasts are cells which have long been named as being responsible for the absorption and growth of bone. The origin and function of the osteoblasts has been misunderstood, as many writers have attributed it as being related to and a part of periosteum.

The periosteum has no osteogenic function and the osteoblasts have but two sources of origin; namely, a mesoblastic cell or preexisting bone corpuscle. If the periosteum was responsible for the growth of bone as has been accounted by the essayist in his paper, orthodontic treatment would be practically impossible. The essayist has used the term "subtraumatic tooth movement," and while we are willing to admit that much tooth movement is of that type it is a movement which should be created accidentally rather than intentionally. Orthodontic treatment along proper physiologic lines does not produce any traumatism or even a subtraumatic condition but should be the result of purely physiologic growth as the result of mechanical stimulation.

Dr. George Northcroft.—I want to ask only one question, which seems to be necessitated by some remarks made by Dr. Dewey in his discussion. He referred to the interstitial growth of bone and I should like to ask him exactly what he means by that expression.

In England we have entirely abandoned this idea of interstitial growth of bone as being impossible as my confreres and I understand the expression to have been interpreted before. We consider that growth can only take place on the surface of the bone from the periosteum, or at the sutures, and to conceive of bone being blown up, as it were, like a balloon, is an impossibility, not a physiologic fact, and I should like it if we could have a further explanation from Dr. Dewey, if that would not take up too much of the time of the meeting.

Dr. Milo Hellman, New York City.—There is a tendency apparent among some discussers to criticize certain points and not to discuss the papers as such. I am rather opposed to such an attitude because I feel that every contribution made at this meeting has some good in it and that the part that is good is for the benefit of the profession. I am especially elated to notice such qualities in the three papers read before us this morning. It is my opinion that every one of them has certain values that are of fundamental and scientific importance to orthodontic progress. If a slight error be discovered later—often attributable to enthusiasm in the work—it must be overlooked because the fundamental structure of all of these contributions is essentially for the benefit of orthodontia and as such it constitutes a stimulus which I believe will send us a good way in the right direction.

I especially wish to mention two facts which are very near and dear to my heart; it is really one fact, mentioned by two essayists, and that is the value of qualitative analysis as used in science. Now, science has been getting along very well with qualitative studies only, but since the adoption of the quantitative method there were more facts pointed out to the scientific world than was hitherto possible by qualitative methods alone.

Dr. Detlefsen mentioned the coefficient of correlation. I wonder how many of us know its meaning and what it stands for. Yet, I am convinced that it is an important thing for us to know. Dr. Derivaux mentioned the mean, the standard deviation and the probable error. These are all matters of importance when dealing with problems associated with variation.

Another point necessary in evaluating the significance of any contribution is the idea of the quantity itself. It is not always necessary to point out a certain fact by means of a million instances. Sometimes a small sample of a large number of things will point out exactly the same truth. It may be elaborated later on by many examples, but the fact, nevertheless, remains the same.

I can do nothing better than express my whole-hearted appreciation not only of the value of the contributions, but also of the method in which they were presented. I would highly recommend to those of the orthodontists who are seeking to elevate the profession and contribute to the progress of orthodontia, that they take the question of quantitative analysis more seriously, that they pay more particular attention to it, and, if possible, take up the study of it. It will do all of us a great deal of good.

Dr. Derivaux.—I very much appreciate the comments of the several gentlemen who have taken part in the discussion, particularly the introduction of the slides shown by Dr. Dewey.

In answer to the question propounded by Dr. Northcroft, I think I can answer it as far as my own views go; there is no fixity of opinion on it. Bone formerly was regarded as being laid down, fixed, comented as it were, by its intercellular calcium-bearing matrix and winding up its days pretty much originally as laid down, always excepting the architectural changes imposed by changes in functional demand.

Such bone growth from the time of first origin was attritionary, laid down by the osteogenitic layer of the periosteum on the surface of the bone and at sutures, and for all I know, there has been no evidence introduced until recently to show interstitial growth, growth in the bone itself below the osteogenetic surface, if you care to call it that, takes place.

The most recent reference to show that growth within bone can take place is contained in a paper which is by Bass (?) in the *Anatomical Record,* and shows that there is at least some measure of capacity for bone reproduction within the bone. How far that goes there is no unanimity nor can we take a strong position. I think, personally, the bulk of bone growth is attritionary on the surface, of course, always molded by factors which I mentioned.

I very much appreciated the comments of Dr. Hellman. There is no doubt that the introduction of a proper quantitative biologic approach will work as great results in orthodontia and mold its thought to a large extent as it has in other fields of work.

PRESIDENT'S ADDRESS*

By Dr. O. E. Busby, Dallas, Texas

IT AFFORDS me great pleasure to greet you and to extend to you a most cordial welcome to the Sixth Annual Convention of the Southwestern Society of Orthodontists, and I wish, especially, to congratulate this Society upon its accomplishments.

It is not my intention to recite a history of this organization, but at this time my mind reverts to the first orthodontic meeting ever held in the Southwest. There were five men present, drawn together for the purpose of organizing a society for the promotion of the study and a better understanding of the science of orthodontia and for the mutual helpfulness of its members. From this nucleus has grown the Southwestern Society of Orthodontists, in which the aims and purposes of the original society have met with a fuller realization than that of its constitutional requirements.

Although a constitution is necessary in the formation of a society, the success of an organization is dependent, not upon the high ideals incorporated in the constitution, but upon the character of the men composing the membership and their spirit of loyalty and cooperation. This spirit has been a vital factor in developing the Southwestern Society of Orthodontists into one which stands second to none, in attendance, faithful performance of duties assigned and sincerity of purpose. With this spirit it is not remarkable that this Society should have attained a degree of such importance that it attracts to its conventions visitors of international distinction, nor is it surprising that in an environment of good fellowship, confidence, and esteem, the technical and scientific elements should have assumed a greater and keener interest.

While the orthodontic world has entered upon a new era, an era of appreciation of the biologic subjects and problems involved in the management of orthodontic cases, we realize full well that there are many problems yet to be solved, that there is much study and work yet ahead of us, so let us be admonished to a continued study of the subjects we hope will aid us in the tedious solution of these problems, and also, to establish a closer and deeper reciprocal relationship with those who are studying and working in the various departments of dental and medical sciences, thereby winning for orthodontia that recognition which it so justly deserves.

The World Orthodontic Congress to be held this month (August) in New York marks an epoch in orthodontic advancement, a wider interest in the exchange of ideas and experiences and a greater desire to contribute to the science, and to receive such inspiration and acquire such knowledge as may be possible.

*Read before the Southwestern Society of Orthodontists, Houston, Texas, August 3 to 7, 1926.

The factors governing orthodontic procedure are so varying and change so rapidly that one is reminded of Mark Twain's comment on New England weather, "the changes are so frequent as to dazzle one's mind."

The Southwestern Society of Orthodontists has been able to keep well apace with the advancing conditions through the association with many of the most eminent authorities and contributors to the science of orthodontia and by the acquisition of their friendship. We are grateful for their instruction and proud of their friendship. It has been said that a friend is more to be desired than great riches and in our friendships we and our Society are wealthy indeed. A quiet steady glow of friendship, has attended the growth and progress of the Southwestern Society of Orthodontists, throughout its existence—friendships which seek no exultant reward and which the years will not abate. I am offering no recommendations for the future conduction of this Society, no dissertation on orthodontics, or essay on friendship. I wish only to express my appreciation of the confidence you have reposed in me and to thank you for the honor you have conferred upon me.

My association with you has increased my knowledge and has enriched my life and I entertain the hope that the same impulses of confidence, friendship and love of knowledge will prompt the conduction of this Society in the future as it has in the past. With this assurance it is my belief that this Society will grow in members and attainments and will continue among the greatest forces in the world for the promotion of orthodontic science. Its beneficent disposition and successful accomplishments will redound to the health and happiness of future generations and to the credit of the Southwestern Society of Orthodontists.

TRAUMATIC OCCLUSION*

By J. P. Arnold, D.D.S., Houston, Texas

TRAUMATIC occlusion, or occlusal trauma, may be defined as an excessive thrust or pressure at one or more points in one or more of the ranges of occlusion. It is an abnormal occlusal stress which is capable of producing or has produced an injury to the periodontium (see Stillman, C. P.). It is stress in excess of the normal, or in other words, it is plus occlusion.

When a condition of plus occlusion, or traumatic occlusion, is found to be present, one of two things will occur: either an increased alveolar support is provided by Nature, or a breaking down of the supporting tissue will take place.

Traumatic occlusion may be either a potential or an actual injurious agent; as long as no tissue change has taken place the stress may be looked upon as a potential injurious agent; however, as soon as a tissue change occurs it must be regarded as an actual traumatic occlusion.

Traumatic occlusion does not mean malocclusion, unless the malposed tooth is producing an irritation, and traumatic occlusion may coexist with apparent normal occlusion, both in those cases in which the arches have been developed normally, as well as those which have been treated by orthodontists; the presence of gingivitis and deposits persisting after orthodontic treatment indicates definite occlusal trauma, and should be carefully corrected.

You may have normal mesiodistal and buccolingual relationship, normal vertical relationship to the line of occlusion, normal inclination of the roots of the teeth, normal occlusal surfaces, normal approximal contact points, yet without proper compensatory wear of the inclined planes through use in mastication, which wear will bring about a gradual diminution of buccolingual stress, could we expect complete occlusal coordination, which is really normal occlusion.

It is my belief that occlusal stress is present during the period of youth, but does not necessarily act as an actual traumatic occlusion, on account of the high resistance to infection possessed by the periodontal tissues at this time; the relatively thick pericementum permits considerable tooth movement within its socket, and the vascular structures may accommodate themselves to the deformity during the entire period of youth.

Conditions interfering with the freedom of the oscillatory movements of the mandible, such as the results of a buccolingual tipping of the roots of a bicuspid and molar, thereby altering the relationship of the cusps to the line of occlusion, molars that have become tipped mesially in the course of shifting following the loss of approximal contact whether resulting from extracting or failure of the dentist to restore full approximal contours, occlusal

*Read at the Southwestern Society of Orthodontists, August 3 to 7, 1926.

stress being delivered at an angle other than that which it is intended to receive.

Supraocclusion or elongation of the teeth also produces occlusal trauma; in fact, an analysis of any case of traumatic occlusion will reveal the presence of one or more of these abnormalities. When traumatic occlusion exists and the tooth is held rigidly in one position by a splint or bridge and this tooth has no opportunity to partly accommodate the traumatic occlusion by moving in its sockets, pocket formation in such a case once begun progresses much more rapidly than otherwise.

DETECTION AND CORRECTION OF TRAUMATIC OCCLUSION

Orthodontic treatment, of course, represents the ideal method of treatment or adjustment; grinding the occlusal surfaces, however, is more frequently resorted to. In those cases presenting an extreme overbite of the incisors and cuspids, opening of the bite in the bicuspid and molar region has been recommended; this treatment, of course, is to be carried out only by one who has the fullest understanding of the occlusal requirements.

Every tooth having a gingival infection is to be suspected of improper cusp relation; serumal calculus and the presence of a dark red line extending from the gingival margin parallel with the tooth root are also some of the diagnostic signs; recessions of the marginal gingivae are also to be considered symptoms of traumatic occlusion.

Traumatic occlusion is easily detected by allowing the tips of the fingers to rest lightly upon the crowns of several adjoining teeth, and instructing the patient to close the jaw to and fro in all directions, and attempting to bring force on the particular tooth which we are examining; if traumatic occlusion be present it is easily felt; carbon paper is now used to locate the exact spot, and grinding is then resorted to.

There is a great variation in the opening and closing ratio of the molars as compared with the incisors; a slight amount of relief on the second and third molars causes excessive pressure and trauma on the anterior teeth. (House, "Traumatic Occlusion as a Factor in Periodontia.") This is a factor to be considered when we attempt to restore occlusal balance. I have observed more second and third molars affected from trauma than any other teeth; a few years ago we wondered why so many third molars were loose when the rest of the teeth seemed firm; a close examination of these cases will invariably disclose a severe traumatic occlusion.

The use of hard golds and other materials used in restorative work, which vary greatly in wearing properties, incorrect occlusal forms and tooth anatomy have contributed much to the presence of occlusal trauma in many mouths. In my office we are returning to softer golds for inlay work; it would mean much to find a material whose wearing properties harmonize with the wearing properties of the natural teeth.

Just as crowns, bridges and fillings should be kept under surveillance for some time after their insertion to detect a possible trauma, so also should cases of malocclusions that have been corrected by orthodontic treatment be carefully examined from time to time. It means nothing to study the cases

from plaster models in a position of rest; normal occlusion must deal with the relation of the inclined planes during the function of mastication (or what is termed eccentric occlusion), and no occlusion should be considered normal simply because we have normal mesiodistal relations of the arches.

To appreciate balanced or anatomic or normal occlusion we must realize that the natural dentition having the same function as the artificial one will be governed by the same law of mechanics, and a violation of these laws will produce a disturbance in the natural dentition just as it will in the artificial denture; one tooth must not interfere with the proper function of any other tooth, unless we expect to have changes in structure and function which will lead to diseases; traumatic occlusion may be only a mechanical disturbance of function, but it surely leads to disease.

DISCUSSION

Dr. W. H. Scherer, Houston, Texas.—This excellent paper, presented by a man who has had the advantage of orthodontic training and practice, combined with years of experience in general practice, presents only a few very minor differences of opinion. These being in the nature of supplements to facts presented. Being requested to consider this paper from the periodontist's viewpoint, I am taking the liberty of answering some recent criticism regarding this etiologic factor of periodontal disease and our methods of treatment.

1. It has been found that function is the most important factor in the maintenance of health. It follows that interference with function is most frequently the opening wedge for disease. In the mouth, either insufficient or excessive function has been found to be the predominating factor in the production of periodontoclasia. Since excessive function is by far more common than insufficient function, it may appear that we give this factor undue emphasis. Where we add to the significance of functional and systemic disturbances the factor of mechanical injury, the emphasis will be found to have been well placed. The restoration of normal function then is the problem involved in the treatment by the periodontist.

2. Traumatic occlusion is no longer a new idea or theory, but as is frequently the case, the profession is divided by a difference of opinion concerning the phenomena involved. Much of this difference of opinion is due to failure to recognize the definite symptoms of traumatic occlusion, also indifference to tooth forms and occlusion in restorative work.

I believe the normal lines of force on the teeth are frequently misunderstood, it is the excess lateral and mesiodistal stress and not the vertical stress which produces the greatest amount of occlusal trauma. The greater the vertical stress on the root in proportion to the anteroposterior and the lateral stress, the greater the probability that the teeth and investment tissues can withstand the stress placed on them in occlusion and mastication, and the longer their period of usefulness.

"In the act of swallowing saliva, the teeth are in central occlusion and a positive pressure of from five to fifteen pounds exerted upon the occlusal surfaces." (Monson.)

It will be found that in eating hard substances, the jaws are moved laterally until the teeth are in position to exert the greatest stress. This is an unconscious act, in which the stress is placed as nearly as possible at right angles to the long axis of the teeth.

During deglutition, the jaws are at rest and the teeth are in central occlusion, with no opportunity to adjust the line of force. Therefore, an injurious pressure is constantly applied on the occlusal surface of teeth, not in occlusal harmony, causing injury to the periodontium. The traumatic occlusion during mastication is negligible compared to that which occurs when stress is applied while the mouth is empty and in central occlusion. In the act of chewing, the jaws move laterally, directing the line of force on the lingual occlusal cusps of the upper teeth diagonally toward the lingual, and on the buccal occlusal cusps of the lower teeth diagonally toward the buccal. The greatest wear is on these surfaces and a condition of traumatic occlusion is produced unless the wear is a compensatory one. Nature has fortified the upper teeth by providing a greater alveolar support on the lingual than on the

buccal and the lower teeth, by a greater alveolar support on the buccal than on the lingual. Since the advent of prepared and predigested foods the cutting edges of the teeth have not been required to function as much, and they cease to wear, producing thereby a trauma. During deglutition, when the jaws are at rest, there is contact only on the buccal occlusal cusps and the lingual surfaces of the upper teeth and the lingual occlusal cusps and the buccal and labial surfaces of the lower. The line of stress is then buccally and labially on the upper and lingually on the lower, which is the line of least resistance. This condition is just exactly opposite to nature's plan, and is the forerunner of traumatism, with the weaker number suffering the greatest injury.

3. It will doubtless occur to many that certain individuals give evidence of having an occlusal stress on one or more teeth, yet fail to develop noticeable periodontal disease. This occlusal condition judged by itself would be designated traumatic occlusion. The question arises as to why has this condition failed to produce periodontoclasia. The answer lies in the element of resistance to infection, plus a natural abrasion that sooner or later removes the inharmonious surface and with it the element of trauma.

Following this argument to its conclusion might bring us to the point where we would endeavor to treat periodontoclasia by raising the resistance to infection, rather than by adjustment of occlusion. This effort has been made, but with the exception of the tooth-brush, no artificial agency has so far been found that is adequate to the task. Unfortunately but few individuals possess a sufficiently high natural resistance. We have, therefore, found it necessary to assist the resisting power of the periodontium by removing artificially the irritation produced by inharmonious occlusion.

Regarding the undue abrasions of the posterior teeth: Traumatic occlusion is caused by the force exerted by the muscles of mastication as transmitted through the mandible. The amount of force applied to any tooth depends not only on the number of pounds pressure exerted by the muscles of mastication, but on the distance of the tooth from the point of attachment of these muscles. Surface wear and interference with the full occlusal function in the younger patients should have close observation. If periodontal lesions persist after other causative factors have been eliminated, the problem becomes more complicated.

If sufficient malocclusion or interference is present, orthodontic treatment is indicated, this is preferable. Slight interferences will correct themselves by a natural abrasion. If periodontal lesions still persist conservative correction is indicated. If traumatic occlusion is the inaugurating factor in the progression of events leading to periodontal disease, surely the early recognition and correction of this factor forms an integral part in any comprehensive program of oral prophylaxis.

The use of casts is indicated in the difficult and complicated cases. Properly mounted on an anatomic articulator makes it possible to view all the surfaces of the teeth in their various positions of occlusion. Patients occasionally avoid occlusion on tender teeth, not intentionally, but probably due to faulty chewing habits and consequently limit movement of the mandible. The use of casts is good practice, particularly for the beginner on this work.

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BRIEF DIGEST OF RECENT LITERATURE PERTAINING TO ORTHODONTIA*

By Howard Dunn, D.D.S., San Francisco, Calif.

IN A review of the orthodontic literature covered during the year of 1925, one could not help being impressed with the vast amount of material dealing with the etiology of malocclusion, especially as it concerns diet and function of the endocrine glands.

The former we are all more or less familiar with, possibly not to the extent of its influence upon bone growth and development relative to the jaws and teeth, but more to its effect on disease as concerns the general health. We are all convinced of the effect of diet modification in the treatment of various ailments. The latter, the endocrine glands, is a comparatively new subject and may or may not be overestimated in its value.

For convenience I have divided this paper into etiology, age and speed of treatment, and appliances used.

Babnick of Minneapolis in the April issue of the *Journal of the American Dental Association* believes that the most serious and widespread physical defects are dental caries and faulty development of the jaws and palate, nasal obstructions, adenoids, enlarged tonsils and rachitic deformities and are due to errors in nutrition.

Softness of the food, deficiencies in vitamines and salts are primary factors in producing malocclusion. Softness of the food prevents proper mastication, causing poor muscular development which in turn is responsible for a consequent poor development of the bones. The pull of the masseter muscle in vigorous mastication undoubtedly has a widening effect on the lower jaw and actual biting force of mastication must tend to spread and widen the maxillae and palate. The pterygoid plate of the ethmoid is in close relation to the lateral walls of the nasopharynx and to the palate bone, which form the outer walls of the posterior part of the nostrils. The outward pull of the pterygoids would seem to have a widening effect on the nasopharynx and posterior part of the nose, the parts that are so frequently narrowed and obstructed. The primary developmental errors therefore seem to be in the lack of function of the jaws, and not in the nose or palate.

McCollum, as quoted by Babnick in the same issue, states, "That malnutrition is not ordinarily the secondary result of physical defects, but is a primary cause, and nutritive conditions have to be regulated in a scientific manner to insure optimal well-being."

Sir Harry Baldwin, in the January issue of the *Pacific Dental Gazette*,

*Read before the Pacific Coast Society of Orthodontists, San Francisco, Calif., February 16, 1926.

shares in the view that poorly developed teeth and jaws have resulted from a generally prevailing avitaminosis, traceable to the following causes:

(1) The high milling and refining of wheat flour.
(2) The use of highly milled rice (polished rice), corn flour, pearl barley, sago and tapioca, all of which have no vitamins.
(3) The hand feeding of infants.
(4) The use of factory foods, such as egg substitutes, custard and jelly and soup powders which contain no vitamins.
(5) Too exclusive use of muscle meats (beef, mutton and fish) to the neglect of internal organs as food.
(6) The substitution of tea and coffee for beer.
(7) The abandonment of rye, whole barley and, to an extent, of fresh oatmeal as a food.

"The constitution of the jaws and teeth are determined largely before birth and almost entirely before the age of five years, so consequently it is during these early years that the need is most extreme for a complete and properly balanced diet."

A diet which will include such articles of food as milk, butter, eggs, fresh leafy vegetables, fresh fruits and whole grain, will be conducive to good tooth and bone development.

Hellman, in the *Dental Cosmos* of February, corroborates these views and adds that heredity no doubt plays an important part.

"In rats an endeavor to produce rickets by faulty nutrition failed, but by feeding ricket-causing diets throughout one generation into the next, the result was accomplished. Therefore, if the parents' health is undermined the offspring is a susceptible skeleton which, when unfavorable dietary conditions present themselves, makes the offspring more liable."

Not alone should the child after birth be considered, but the dietary of the mother should be outlined during her pregnancy. Dewey, in the October issue of *The Journal of the American Dental Association,* says, "The etiologic factor may be divided into congenital and acquired condition. Probably the congenital factors play a greater part in the production of malocclusion than was realized a few years ago. These conditions are fortunately easily controlled."

"If the mother is undernourished or does not eat the proper food, the embryo will be defective and this will result in constitutional disturbances in the individual after birth."

Not only is diet important in the formation of normally developed bone, but an insufficiency in the diet of the antiscorbutic vitamins and of calcium readily shows its effects upon the teeth.

Howe, in the November issue of the *Dental Summary*, "The Relative Importance of the Diet as a Factor in Dental Disease" states, "Animals on a diet high in protein and low in antiscorbutic substance have had rapidly progressing caries. This has also occurred when the ash of the diet was acid or when the diet lacked roughage." He quotes Hojer, "That when almost enough of the antiscorbutic factor is furnished for the body requirements,

yet not enough, no pathology is to be found in the body except in the teeth. Lack of roughage has a deleterious effect upon calcium metabolism." Howe concurs with writers mentioned above that diet should contain less meats and cereals and more fruits, vegetables and milk, which contain the vitamins and the basic mineral salts which contain the calcium and roughage." He further states that "We have not as yet found caries as a result of excessive sugar and starch feeding. Not only is this diet factor applicable during early childhood and during pregnancy of the mother, but must be adhered to during life, for it is possible to produce demineralization of the enamel and softening of the dentine due to diet deficiency."

He goes on, "That bones deficient in calcium metabolism have become calcified, the jaws and nasal cavity are then narrowed by muscular stress and erupting teeth, lacking space erupt irregularly. One of the causes of irregularities of the teeth, therefore, seems to be a disharmony between calcium metabolism and muscular development."

Sir Arthur Keith, in the *Living Age*, Jan. 2, 1926, "Man's Structural Imperfections" in his examination of three hundred skulls of individuals who lived in England more than 1000 years ago, noting the narrowed plate, states: "The reduction of size in the palate and the defects in the formation of the jaws, and the facts that accompany them, are merely results of the soft and highly prepared foods we eat, and chewing muscles being deprived of the work that fell to them in more primitive times."

Hoffman, in a paper upon diet, which was presented before this Society, and printed in the February issue of the INTERNATIONAL JOURNAL OF ORTHODONTIA, ORAL SURGERY AND RADIOGRAPHY, believes it is within the realm of the orthodontist to prescribe the necessary diet for the patient, but this seems to be overstepping that part which has been allotted to us, it seems rather that more cooperation between the physician or pediatrician would be more in the proper channels.

A consideration of the endocrines and other glands might possibly be a thing which, as stated before, may become of some importance later on, as this branch of the science develops. At present, although a number of articles have been written about it, it seems to be somewhat theoretic and far-fetched. It appears that problems such as diet and nutrition, lack of proper function and other etiologic factors seem to have a more direct bearing upon malocclusions of the teeth.

Louis Berman, M.D., in his article, "Some Relation of the Teeth to the Endocrine Glands," read before the Eastern Association of Graduates of the Angle School of Orthodontia in the January *Dental Cosmos*, states that "the teeth and jaws have been a tremendous aid in the study of this science because of the clinical manifestation they present for study." He warns, however, that "their knowledge is distinctively limited after some thirty years of study along these lines."

"One of the accepted generalizations is that endocrine glands, in a general way, control calcium metabolism, just as they control every other manifestation of metabolism."

"The teeth present various degrees of calcification according to the degree of domination of one of the endocrine glands, and in persons in which the thymus gland dominates the metabolism, the teeth are of lower density and have little resistance to decay and wear. Those in which the thyroid gland dominates have teeth of harder or denser structure and are more resistant to decay, and the process of occlusion in them seem to be better balanced."

The pituitary domination presents types of a higher degree of calcification. They present some kind of disturbance in forms of occlusion or malocclusion, and are types which present orthodontic problems, for it is this gland which has great influence upon bone development and consequently has a great influence in the development of the upper and lower jaw."

"In types which are described as thymopituitary, or one in which the child is hypopituitary with a degree of thymus dominance, the teeth are small, irregular and crowded."

"The adrenal domination presents types of the highest degree of calcification and are more regular and are least liable to caries."

"Eruptions of the teeth are credited to the function of these various glands. The thyroid gland of the newborn babe contains no iodine or it contains none of the active secretion of the thyroid or thyroxin which is only supplied by the mother during time of pregnancy and later through her milk. This iodine appears in the babe's thyroid about a month before the normal time of appearance of the temporary teeth and manifests itself in the appearance of the ridges in the mouth, from which the teeth erupt."

"The high or Gothic type of palate is associated with the thymo-pituitary-gonad type, or, if there is an insufficiency of the thymus, there will be a disturbance of the balance in the degree of development of the palate bones, presenting the Gothic type."

Wm. Engelbach and McMahon of St. Louis, in the February issue of the INTERNATIONAL JOURNAL OF ORTHODONTIA, ORAL SURGERY AND RADIOGRAPHY, also bear out the statement that "the endocrines have a great influence upon calcium metabolism, and bone growth, especially as related to the thymus gland."

Dr. Hellman in the February issue of the *Dental Cosmos,* substantiates the endocrine theory by stating: "The mechanisms that convert foodstuffs into materials of the body are controlled by the internal secretions. That rickets are found in cases with impaired thymus secretion. Not only endocrines but other internal secretory glands control metabolism."

The thyroid is the foremost metabolic regulator of the body.

Dr. Howard, of Atlanta, states in the March issue of the INTERNATIONAL JOURNAL OF ORTHODONTIA, ORAL SURGERY AND RADIOGRAPHY: "Deficient thyroid secretion manifests itself in malshaped craniums, retarded brain growth, short and stubby fingers, retarded mentality, malformed dental arches and congenitally missing teeth."

"Acromegalies are the result of disorders of the pituitary gland, while the hypogonads present a decided malformation of the dental arches."

R. B. Wood, M.D., of Knoxville, Tenn., in the October issue of the INTERNATIONAL JOURNAL OF ORTHODONTIA, ORAL SURGERY AND RADIOGRAPHY, substantiates the above-mentioned men, but concludes that "as yet in regular gland therapy in endocrine disturbances our chief reliance is in thyroid extract. Pituitary feedings occasionally give fair results, but its efficiency by no means equals that of the thyroid. Unusual claims made by many enthusiasts and exploitation by pharmaceutical houses are partly responsible for the present day indifference of many medical men to endocrinology as a whole."

"Endocrine disease is rare, but yet it holds a definite place in medical science."

Karl Thorleif, of Sweden, in the April issue of the *Dental Cosmos* says, "The endocrine glands are so intimately related with one another that they ought to be regarded as a whole and that each of them is necessary for normal development of the body."

Dewey, in the October issue of the *Journal of the American Dental Association*, divides etiology into congenital and acquired causes, congenital having been discussed under the influence of the mother's diet, while under acquired conditions he believes that the lack of care of the deciduous teeth are the prominent factors in causing malocclusions.

Deciduous teeth should be filled with a permanent filling material with anatomic form of the tooth reproduced, not only as to diameter, but every cusp and groove as well. Of the six forces of occlusion that have been analyzed, the force of proximal contact and the force of the incline planes are as important as any and the loss of both will always be a predominating factor in malocclusions. Not only has the deciduous tooth a bearing upon malocclusion, but the loss of the first permanent molar as well. He states: "We must start a campaign for the preservation of the first permanent molars, which are the cause of a number of difficult cases of orthodontia later in life.

O. Henry, of London, quotes from Dewey in the June issue of the INTERNATIONAL JOURNAL OF ORTHODONTIA, ORAL SURGERY AND RADIOGRAPHY, "We can diagnose rachitic conditions by early shedding of the deciduous teeth and the late appearance of the permanent teeth. While the late retention of the deciduous teeth after appearance of the permanent teeth, indicates a tubercular diathesis. This is explained by the fact that in a rachitic child, a low degree of metabolism is present and rapid absorption of the roots of the deciduous teeth goes on because the system is withdrawing calcium from wherever it can in the body, and is not building permanent teeth, for the body processes and the bones are more vital than the teeth."

In tuberculous diathesis the reverse is true, for the roots of the deciduous teeth are not absorbed as rapidly as the permanent teeth are formed because the rate of metabolism is higher.

C. D'Alise of Naples, in the July issue of the INTERNATIONAL JOURNAL OF ORTHODONTIA, ORAL SURGERY AND RADIOGRAPHY, believes that heredity, syphilis and predisposed tubercular patients are to be considered as etiologic factors.

Chapman, of London, says that close bite cases are far in the majority, of which we are called upon to treat and cases which are more difficult to maintain. He says, "Of these little is known of the etiology and can only be given as a lack of function."

Some of the latest and most scientific contributions to the etiology of malocclusion are those given to us by Harvey Stallard in his article in the March *Dental Cosmos* entitled, "The General Relation of Pillowing to Malocclusion." This article we are all familiar with and needs no further comment here.

A surprising number of writers mentioned seem to favor heredity as an etiologic factor in malocclusion, among them Drs. D'Alise, Hellman, Lundström and others.

Possibly another of the best scientific preparations is a series of articles by Alex Lundström appearing in the October *Dental Cosmos* and July to December issues of the INTERNATIONAL JOURNAL OF ORTHODONTIA, ORAL SURGERY AND RADIOGRAPHY. Whether we are inclined or not to agree with his deductions, it has taken considerable thought and collection of data in its preparation. The articles are too lengthy to take up thoroughly at this time and further consideration should be given them at our local section meeting, or at some future period in the Pacific Coast Society meeting.

A brief summary is that most cases are problems which are deficient in their development of the apical base, this lack of development may be in a lateral direction as in cases of narrowed arches, horizontal, in which are presented Class II and III cases, and vertical or overbite cases. He is of the opinion that diet, endocrine glands and function have not been proved to be definite causes of malocclusion, but that a deficiency in the development of the apical base, or that portion of the bone that joins the alveolar process in the region of the apices of the teeth, is the primary cause, and may be due to heredity. It is these types of cases which prove to be failures in their treatment, and only are they successful when development and growth in this base are factors which work hand in hand with the mechanical treatment given. Bodily movement appliances in no way influence development any more than do other types, but rather growth in the body of the bone which accompanies mechanical interference.

There has been no new development in appliances, except those of McCoy's, with which we are all familiar. However, there seems to be a problem confronting the profession relative to the use of appliances and the speed with which cases are to be treated. One faction seems to be of the opinion that all corrections should be brought about in periods of from six to eight months with bodily movement appliances. Very little appears in the literature concerning this method, but a great deal of undercurrent by word of mouth is continually circulating. The other faction which seems to be made up of men who have been able to attain high rank in the orthodontic field and who seem to have the faculty of thinking for themselves, and this coupled with years of experience, hold that a slower period of treatment brought about by the use of appliances causing slight stimulation is the proper method.

McCoy, in the June issue of the *Journal of the American Dental Association,* says: "From a prominent sectarian group of orthodontists, misinformation is being broadcast in form of rapid treatment, the inference being made that, through magic influence of a certain patented appliance, physiologic tooth movement occurs, and as a result, treatment is terminated in a period ranging from a few weeks to a few months," and he goes on, "That orthodontia has not been reduced to an exact science is apparent from the fact that all too frequently relapses occur after treatment showing that either the original cause has not been removed, or, in the movement of the teeth, tissues have been abused to the extent that they are lacking in the vitality essential to carry through the process of adaptation to their new environment." In orthodontic tooth movement, especially in young children, the degree of tissue tolerance is great; but this should in no wise justify us in utilizing abusive measures. These contentions seem to be borne out by Ketcham, Dewey, Young, Lourie, Oppenheim, Chapman, Mershon and innumerable others. With Mershon's ideas we are all familiar.

Mayer, of London, in the December issue of the INTERNATIONAL JOURNAL OF ORTHODONTIA, ORAL SURGERY AND RADIOGRAPHY says, "There is a certain amount of conviction among dentists and medical men and even the public, that the movement of teeth by orthodontic appliances can cause a peridental degeneration predisposing to pyorrhea. Orthodontic treatment is carried out by men who concentrate on the knowledge of the apparatus and who are inclined to neglect the anatomic and physiologic considerations underlying tooth movements, moving them with insufficient caution, satisfied if they are able to produce a pleasing result as soon as possible. It is evident that any force applied must be in the nature of a stimulus rather than a pushing force."

Young, in the March issue of the INTERNATIONAL JOURNAL OF ORTHODONTIA, ORAL SURGERY AND RADIOGRAPHY says, "Careful and intelligent use of delicate mechanical appliances causing slight stimulation in the proper direction, without causing pain, is followed by far more beneficial results than are other forms of treatment. We should ever bear in mind that pain is Nature's way of letting us know that something is wrong."

Oppenheim, being quoted by Mayer in the December issue of the INTERNATIONAL JOURNAL OF ORTHODONTIA, ORAL SURGERY AND RADIOGRAPHY says, "Bone tissue, be it compact or cancellated, reacts to pressure by a transmormation of its entire architecture; this transformation results only upon the application of very slight physiologic like stresses. Should the stress used be considerable, there will be an entire absence of such bone formation whilst the blood vessels of the peridental membrane appear to suffer degenerative changes and it is of course upon the well-being of these blood vessels that the formative power of the osteoblasts and other cells depend."

We have to take into account that bone formation of different individuals varies, that in some mouths the proliferating potentiality of the osteoblasts is exuberantly vigorous, whilst in others it is relatively feeble. This we can note clinically in our own practices.

A number of articles are devoted to the age at which orthodontic treatment should begin.

Fletcher, of Oklahoma City, in the September *Journal of the American Dental Association,* says, "The earlier the teeth are placed as it was intended, the more nearly will development and growth go on normally." He believes that the arches should be artificially developed prior to the eruption of the bicuspid and cuspids. This is in reference to cases in which the jaws are normal in their mesiodistal relations.

Busby, of Dallas, in the same Journal, says, "During the period between the loss of the deciduous teeth and the eruption of the permanent teeth, there seems to come a lapse or cessation in the harmonious development of the structures supporting the teeth. It is during this transition that most malocclusions develop, which would indicate that the inherent powers succumb to the environment more readily at this age of the child and it would seem to indicate that this period is the logical time to institute orthodontic treatment."

Hawley, discussing Young's paper in the March issue of the INTERNATIONAL JOURNAL OF ORTHODONTIA, ORAL SURGERY AND RADIOGRAPHY on "Early Treatment of Malocclusion," says, "This matter of putting appliances on a child four or five years old and carrying them through six or seven years of continual treatment, of continual appliances on the patient, I think should be very carefully avoided if possible."

Lourie in the same discussion says, "There are exceptional cases of course, but that treatment should be instituted at a time when teeth can be guided to their proper positions."

Charles Baker in the July issue of *The Journal of the American Dental Association* has made a résumé of articles which have appeared from time to time and gives us the following: "Angle believes the proper time to correct a case is as soon as malocclusion manifests itself."

The Southern California Section of the Pacific Coast Society of Orthodontists in a resolution unanimously adopted say, "It is advantageous to children suffering with malocclusion of the teeth to be placed under observation as soon as the condition becomes manifest, even though the deciduous teeth only are present and that such cases should be watched and active measures instituted, if the necessity is clearly indicated, at such a time as will prove helpful to the patient, the age of six to eight being a favorable age."

Lischer, in the same article, believes that during the period of eruption of the permanent teeth is the period of greatest growth in the alveolar process and this time is proper for treatment.

Young, in the same article, believes that as soon as malocclusions manifest themselves in the deciduous arch, treatment should be commenced.

Strang, in the same article, is of the same opinion.

Baker goes on, "The proper age is determined not by the actual age of the patient but by the development of his teeth and jaws and by the time when the particular malocclusion develops and may be recognized, and means treatment at the time when the growth of the teeth and jaws makes orthodontic interference most advantageous."

Hoffman, of Buffalo, in the November issue of *The Journal of the American Dental Association,* is of the same opinion and sums up the case as follows: "The age of ten may be considered early treatment in one instance, but it would be decidedly late for those that could have been easily corrected at the age of five. Conversely a case undertaken at the age of five might easily develop into a prolonged course of treatment because of certain interal or constitutional conditions of the patient over which we have no immediate control. The 'best' age for treatment then becomes a matter of careful and mature judgment." It seems that the orthodontist should be the judge and should aim to influence the general practitioner to send the cases at a very early age, that they may be kept under observation and treatment instituted when deemed advisable by the orthodontist.

DISCUSSION

Dr. F. W. Epley, San Francisco.—In the first place, if you have had any experience in reviewing articles you will appreciate what a tremendous amount of work was done to prepare that paper. That is no Sunday-school picnic to sum up all that Dr. Dunn has in the paper. It requires an immense amount of reading and to discuss everything that was in the paper would require the equivalent of a speech on practically every subject in orthodontia. That is out of the question.

There are some notable things in the summing up and one that strikes me, perhaps, most strongly is the reference that is made to appliances. I had occasion to lecture to the members of the Senior Class last year on the "History of Orthodontia" and I rambled through Dr. Weinberger's articles of a number of years back, and I realized the truth of that old proverb that there is nothing new under the sun.

We all know who Fouchard was, that gifted Frenchman, and you would be surprised how many men, along down through these several hundred years since his time, have cried out against the neglect of baby-teeth, the unjudicial extraction of baby-teeth, the indiscriminate extraction of baby-teeth, and the discussions pro and con whether it is better to extract the cuspid or the first bicuspid. There were just as good brains, I think, working on those subjects in those days as there are now.

In looking through some of the earlier literature I jotted down a lot of things, that is, types of apparatus that were used in the old days. I found all of these things: bite planes, rack and pinion, windlass and barrel, molar bands, anterior bands with tubes and springs, outside expansion arch and nuts—Dr. Evans, the famous French-American dentist made and used them—removable appliances and plates, rachets, and vulcanite plates, the use of the fingers in correcting malocclusions in front, the use of pelican pliers in forcing rotation by one twist—all of those things were in use 200 years ago, and I do not find but that practically every modern appliance was anticipated in those old days.

Fouchard was alive to this question, too, of nutrition and it strikes me that that is the greatest subject before us today—these studies in nutrition. He noticed that country children had better teeth than children in town, that is, in Paris; also, that the lowly European peasantry had a coarser diet and he thought that was the explanation. Of course, it is useless for us to assume that if food conditions became ideal that there would be no malocclusion, that there would be no abscessed teeth, that there would be no decay.

I have here a clipping I found in a magazine last night dealing with the Esquimaux, about as primitive a people as we can find. The author said: "They are characterized by an overdevelopment of the muscles of mastication; there are few typical teeth; malocclusion occurs in 11 per cent of the skulls and they are principally Class I cases; about 1 per cent have dental caries, and about 19 per cent of the skulls show apical abscesses." So, the millennium probably will never come so far as teeth are concerned.

I wonder if a vigorous body does not stimulate appetite for those things needful for tooth and bone development and that the peasant class, who live an active outdoor life, do

not have an appetite that is normal and causes them to eat those things which the body craves, while weaklings eat sparingly only of what is before them? The outdoor peasant class chews all sorts of things. The boy in the country chews raw material, green apples, and many things that come in his way, and the city child does not. In all this study of nutrition I am wondering if anywhere anybody is studying the problem of the effects of cookery?

One of the bulletins put out by the Oregon Agricultural College claims to have proved that swine, whose digestion is very much like ours, can obtain considerable more nutrition from raw grain than from cooked grain.

In this connection I am reminded of a personal story. I used to ask my wife to cook some cornmeal mush. She said that she could not afford to cook cornmeal mush for 12 or 14 hours because it took too much gas. She was visiting one day, and I was the cook, and I cooked cornmeal mush. We had all we wanted three times a day. When she came home the first question she asked was, "What did you have to eat?" I said that we had cornmeal mush. Then she asked how long I cooked it. I told her that I cooked it probably 3 minutes. Her hands went up in horror; but none of us were sick.

I remember one time, when I was a child, that I was desperately hungry. I had been skating on a lake miles from home and I stopped at a farmer's barn and got an ear of yellow corn. That was Thanksgiving Day and I knew that a turkey dinner awaited me, but I ate the ear of corn and my hunger was assuaged at once. I believe that we are going to see some studies along the line of the effects of cooking.

Now, the question of diet, to my mind, is still unsettled. I am watching it very keenly. I believe we are on the eve of definite conclusions by the medical profession and the scientists who are studying it. I don't believe that we have quite arrived at that point yet. There are things to think of when those conclusions are reached. They will probably conflict with the food interests entrenched with millions; they will probably conflict with social customs and will probably conflict with the dietary habits of generations. What will be the result and can those things be overcome?

Personally, I inquire into the diet of the patient that comes to me. Usually I find very little out of the way. Most of them have been under the care of a physician. I endeavor to find out these points: Do they drink milk, eat butter, salads, rye bread, crusts, raw food, apples, and so on? Then I find defective chewing habits in the case of a good many. One boy was troubled so with the caries that I trembled every time he came around. I made him quit eating white bread.

Then we have to consider the pamphlets and house journals that are sent around to some of us, which say that they fail to find reason to condemn candy and starchy foods and that knocks the pins out from under some of my theories. But, I think there is going to be a solution of many of the problems of orthodontists bearing on tooth structure and the saving of baby-teeth and the abolition, to a large extent, of caries.

The subject of gland derangement has interested me greatly, but I believe it is still up in the air. Why is it that some of those cases come to us with a tongue as big as a good sized beefsteak and an enormous horseshoe shaped lower jaw along with an underdeveloped upper jaw? One can tell them, when he sees them, half a block away. I believe the solution of many of those things is going to be found in these studies of gland derangement.

I do not believe that the case against eugenics is quite so bad as Dr. Bell would make it out. I believe there is contained in every man's heart or conscience, more or less, eugenic philosophy. Do you suppose, in my younger days, I had any particular admiration for a very slender woman? I should say not! They were not pretty to me in any sense of the word and I did not marry that kind of a woman. I believe that Nature helps us in those ways and yet I believe that that Utopian dream possibly may come true when we select the human race as we select our animals.

The subject of apical base interests me very much. In my own practice I come across one of these Gothic arches and I put a little gentle stimulation in there, and the whole arch widens out beautifully. Then, I am very sanguine and happy and another one comes along and I put in the same treatment and the teeth wing out like doors. Now, I think, perhaps, there is only one thing more I have to say and that is, how to use this literature? The accumu-

lation of orthodontic journals becomes so great one needs a room to keep the journals in. What I have been doing is to tear out the articles that appeal to me that I think I can use and I clip them together and keep them that way and throw the rest away. In that way, within a reasonable compass I have articles of all sorts. I have Dr. Gray's "Investigations on the Supply of Missing Teeth" and I have Dr. Dunn's articles on "Insufficient Vertical Development," and I have all of Dr. Bode's articles that way. When I get a case that concerns one of those subjects I know right where to go and get this information. I do not have to hunt through a lot of magazines to find what I am looking for.

There is one thing that comes to my mind now and that is this: Perhaps, we are not paying enough attention to European journals. The British have some very fine men and some very fine authorities, along these lines.

Dr. J. Camp Dean, Oakland, California.—The hour is getting late and after the beautiful discussion that Dr. Epley has given us I am not going to go into a very extensive discussion of the paper Dr. Dunn has read.

After I received his paper I read some of the articles that he indicated and I assure you that it would take a long time to cover the ground that he has covered in those articles. I find that his deductions have been the meat of the articles and I wish to compliment him on his ability to get at the very essence of the papers that he has gone over to give us the best of them in a few words. There are many other articles that might have been touched upon but I think with Dr. Epley, that the tenor of the articles has been along the lines of development and not of appliances. The development and the diet of children has been uppermost in the minds of those who have been writing on the subjects for the benefit of orthodontists.

Dr. Dewey has given us a good solution of acquired and hereditary causes of malocclusion; the acquired are those things that have happened to the teeth after birth and are by accident, by the loss of deciduous teeth through decay, by the congenital missing teeth, by having one more tooth on one jaw than the other—is bound to cause malocclusion in the arrangement of the teeth.

We do inherit from parents the size of the tooth, the shape and color, and matters of that kind, but, we do not believe that the position of the teeth has anything to do with heredity. Those things are purely matters of environment, except in so far as the health is concerned. If we have a child who has inherent weakness, who has a lack of virility and vitality and if you carry back into the family you find those conditions in either the father or mother or grandparent it may be inherited. He cannot expect to have as well-rounded and full developed teeth, mouth, and jaws of that individual, as in some family of a more primitive development. Our colonial forefathers started on a jaunt in the woods in the early days with a pouch of Indian corn and a piece of jerky,—a diet that would last them for a couple of weeks. Those conditions developed jaws and a muscular apparatus which, by exercise and by use developed strength and well-being for that individual which, I believe, today the diet does not do. They did not have in those days what we consider the well balanced diet. Here in California we are blessed with having fresh fruit and vegetables, which are recommended for two meals a day for the children, the entire year. Yet, we find the development of their jaws and their teeth was very much better than we have in the human beings of today.

There is no question, however, in my mind, from the literature that has been cited that the index of an individual's health can be brought up by a diet and that by increased feeding and improvement in those matters we can restore a function of the bone, of the muscles of mastication and an improvement of the general health.

I had a case brought to my attention this week, over in Oakland, of a widow woman with four girls. They had been living in poverty for a number of years. Evidently the woman had some pride and she did not report nor ask for help, but gave those girls what she was able to furnish. The woman was taken sick and it was necessary to have the children taken away from her. They were taken into a home and had quite a time starting on a new diet. It was difficult to convince them that there was something else to eat beside bread and coffee. Their diet had been composed of that altogether and they did not want to eat anything else. Those are conditions not conducive to normal development.

There is a condition which I call the forceful eruption of teeth, which, in some individuals is lacking and in other individuals it is prominent. I have had occasion in little children, as Dr. Epley has mentioned, to spread the arches, get a development of the maxilla and wait for the eruption of the teeth. In some cases those teeth are slow in erupting; they wait past the normal time and usually come in irregularly. In other children, you get an immediate eruption of the teeth.

There is no stimulus for growth and development of the arch like the eruption of the teeth and that is the *force of eruption.* If you have one tooth missing you lack that forceful expansion because you do not have the contact of those teeth in the unerupted state which causes the development. If a baby has a tooth extracted you get, not a growth in the development of the jaw, but a contraction. I believe the greatest stimulus in the development of the jaw is brought about by the force in the eruption of the teeth.

I thought the mention of Sir Harry Baldwin's article, wherein he lamented the fact that we had substituted coffee for the use of beer and where we had eliminated the use of rye, would bring about some discussion. We are having considerable trouble with that in California.

In regard to the time of treatment, I noted several articles, one by Dr. Jas. McCoy, and I feel that this is a very timely subject to discuss. We have had so many cases of long retention of appliances on the teeth during the developmental period of child life, I feel this is detrimental. Between the ages of six and seven and one-half we have the eruption of twelve permanent teeth, and then there is a lull in development. Between the ages of 11 and 12 we have the eruption of 16 permanent teeth, and the appliances, unless there is some real necessity, should not be left on the childrens' teeth between those periods. We should assist Nature in every way possible in the eruption of the incisors and the first permanent molars and when they are in normal occlusion the bands should be removed until the time of eruption of the second dentition and then perhaps no interference may be necessary.

In regard to appliances, I feel, when I am at a loss to know what to do in the matter of appliances, that I can always resort to my early training, and use a buccal tube and an alignment wire and get myself out of trouble.

Dr. John R. McCoy, Los Angeles.—I do not think all of you realize how much work it is to go through the literature and prepare such a paper as has been presented here. I attempted such a thing back in 1914 or 1915, when our orthodontic literature was quite limited compared to the present day and I can assure you it was quite an undertaking. I know my paper was a very poor attempt, compared with what Dr. Howard Dunn has just presented to us.

Dr. W. J. Bell, Los Angeles.—There is just one little point I would like to clear up. These two papers seem to be so closely allied that it might not be out of order mentioning it.

First of all, as I said, I did not go into details. I did not have time. Now there comes up a question, just where does the inherited come in and the acquired? Where is the fine line of demarcation?

One other thing: There is a misunderstanding as to the treatment of those cases, and particularly, in connection with the inherited one. To go into the details of that, I would not attempt, because that would require a biologic explanation. However, you must remember one thing: That these conditions extend over a great period, hundreds of years, because as I stated in my discussion of Dr. Morehouse's paper these are conditions which are the result of mismating, physically and mentally. Perhaps the first mismating would not be marked.

Now, let us take the case of the father's side of a perfect dentition. Maybe, on the mother's side, two or three generations have had poor teeth and poorly formed jaws. That keeps on and on until the father is involved, from generation after generation, and that is what you must consider and it is not a matter of—are we going to correct these evils today, next year, or the year following? You must remember that string will travel the same distance unwinding that it does winding up. It is going to take just as many generations to undo what indiscretion in the past has done and every bit that has added to the maloccluded jaws in the past is going to take just that much longer to undo, and possibly longer.

Then, you must bear in mind another thing: I have reference to the results of disease—tuberculosis, syphilis, and a thousand and one other things that enters into it.

After all, it furnishes a nice point: Where does the inheritance come in and where does the acquired come in? It is a fine line and it is not easily defined which class it belongs to, if you are going to draw it to a fine line.

Dr. McCauley.—Does anybody recall any valuable piece of recent literature pertaining to orthodontia that has not been mentioned in this paper? If so we would like to know about it. I think that was a wonderful collection which Dr. Dunn has given us and the discussion has been one that will do credit to any orthodontists' society that I know of.

If there is no further discussion we will ask Dr. Dunn to come forward and close the discussion.

Dr. Howard Dunn, San Francisco.—I do not believe I have anything further to say except that I want to thank you for listening to my paper and I also want to thank the members who have discussed it.

BONE REGENERATION*

By Dr. Harold Hitchcock, Oakland, Calif.

THERE are two types of bone regeneration, one a normal physiologic procedure which is constantly at work in all bones and which keeps bone up to normal. The other, which we might call pathologic, is the result of some abnormal condition such as infection or injury.

The problem of bone regeneration and bone growth began to be a problem after Havers, in 1632, first accurately described bone and periosteum.

Professor Arthur Keith relates for us how a certain John Belcher, a recently graduated surgeon, in 1736, happened to dine with a calico printer in London. The thrifty calico printer used the madder soaked bran from his dye vats to feed pigs and in turn fed these pigs to his guests. Their bones, from the madder feeding, were dyed a bright red. This condition was noted by Belcher who tried some madder feeding on cocks. After sixteen days of forced feeding the cock died. He found its bones, and only its bones, stained red. He reported his observation and thereby introduced to the world a method of vital staining.

Belcher went no farther with this remarkable discovery, enough for him to have reported it. Three years later Henri Louis Duhamel having heard of the action of madder on living animals' bones, tried feeding it to several different animals. He again found that the bones of animals fed on madder were stained red and he observed that those of young animals stained redder than those of old.

He discovered that the periosteum of broken bones became thickened and that the chief source of callus was from the periosteum. He found that bone was only stained while madder was fed and that new, unstained bone was laid down over the stained bone, under the periosteum, as soon as the madder feeding was discontinued. He concluded that the periosteum of young bones laid down bone layer on layer and thereby these bones grew in thickness. To him belongs the discovery of the osteogenetic function of the periosteum. That the deepest layer of the periosteum was the maternal tissue of bone.

By drilling holes at a measured distance apart in growing bones, and later measuring the distance between these holes, and finding that in spite of the fact that the bone had grown in length, the holes remained the same distance apart, he concluded that bones grew in length at their ends. He did not ascribe to the epiphyses, this function.

Haller, probably the most important teacher of John Hunter, believed that the source of ossification was the arteries, the periosteum being merely a vascular membrane which nourished bone and Hunter followed him in his belief.

*Read before the Pacific Society of Orthodontists, San Francisco, Calif., Feb. 16, 1926.

At the age of twenty-six, in the year 1754, Hunter began his studies which showed him that living tissue could absorb and remove part of its substance. He noted that when a tooth was removed the socket filled up. In examining the way in which milk teeth were shed and permanent teeth came in he noted that the roots of the milk teeth were eroded, and that the sockets in which they were contained were disappearing. He noted that the last milk molar lay at the root of the ascending ramus of the mandible, but in the adult there was room for three additional permanent molars between the last milk molar and the ascending ramus. Such additional dental space could not be obtained by the mandible's being remodeled during growth by a process of addition and subtraction. The same process he observed in the constantly changing neck of the femur in the growing child.

He concluded that growing bone involved two processes, one of deposition and one of absorption. Thus he explained by absorption, how in growing bones the medullary cavity in bone increased in size as the bone increased in diameter. By resorting to the feeding of madder or vital staining, he was able to prove what he had deducted regarding the growth of the mandible and hip bone.

Although it was sixty years after Hunter's death that Sir George Humphry explained the reason for the obliquity of the nutrient canals in bone, an experiment of Hunter's leads Keith to believe that he had fathomed it. The reason being as you know, that greater growth occurs at one epiphysis than another in each bone, and that the periosteum being adherent at the epiphysis suffers a drag which is greatest towards the most rapidly growing epiphysis, thus causing the oblique foramina.

Thus in the eighteenth century these two men laid the foundation of our knowledge of bone growth. Since then hundreds have sought, and often with conflicting views, to unravel the details of bone growth and repair. Ollier, Barth, Auxhausen, Macewen, Wolff, Lexer and Rhode are most important in the host. McWilliams has compiled references of over five hundred papers on the subject.

Julius Wolff, between the years of 1870 and 1885, carried on observations which led him to the formulation of his law of bone transformation. He found that a deformed bone became perfectly adapted to its function in its new position "according to mathematical law," he finally worded his law: "Every change in the form and function of a bone or of their function alone, is followed by certain definite changes in their internal architecture and equally definite secondary alterations in their external conformation, in accordance with mathematical laws." Or as J. B. Murphy said: "The amount of growth in a bone depends upon the need of it." The above important law underlies all correction of bony deformities, and the causation of many deformites.

From this vast amount of work done by many men we see what appear to be conflicting observations, however, I think the conflict comes chiefly in the interpretation of these observations. One group feeling that the periosteum is simply a limiting vascularizing membrane with no bone-forming

power, another that it has definite bone-forming power. One, that only osteoblasts can form bone, another that surrounding connective tissue can by metaplasia take up the power of forming bone.

Let us present Rhode's conception of the part played by each portion of bone in regeneration or repair—e.g., the part played by each, periosteum, compact bone, endosteum and surrounding connective tissue. And first, let us define periosteum with Lexer and Rhode, as being composed of two layers, "The outer delimiting layer made up of connective tissue and blood vessels which connects with the surrounding tissue and supplies the blood to the bone (the adventitia) and an inner or cambium layer, poor in blood vessels, consisting of elastic fibers running along and about the bone, spindle-shaped connective tissue cells, and fibrils, and a layer of cortical cells with round, dark-staining nuclei (osteoblasts). The periosteum is bound to the bone by blood vessels in and out of the bone and bundles of connective tissue (Charpey's fibers) and by elastic fibers. The union is loose in young animals, firm in old. The cambium layer is the specific bone former and is supplied with blood by the adventitia. The presence of both layers and in proper relation is necessary for bone regeneration. In adult or old bone the osteoblasts of the cambium layer are usually left on the cortex as has been shown by microscopic study after removal of the periosteum. However, in adults if stimulated by trauma or infection the layer may become active and the thickened activated periosteum will form bone either *in situ* or when transplanted into other tissue."

The cambium layer most rapidly fills in deficiencies in bone, caused by trauma, accident or surgery, provided the inert, undifferentiated connective tissue of the surrounding tissue does not fill them in first and prevent it, as seen in the occasional nonunion of fractures or unfilled cavity. Early static stimuli aid this bone production, but if prolonged the process is delayed.

The rôle of the marrow and endosteum is much smaller. Callus, forming from the marrow, digs its own grave by its growth, cuts off its blood supply and then degenerates into fibrous tissue. The ends of broken bones are thus plugged up by this callus and if not helped out from the periosteum, usually cut off their blood supply before union results. The endosteum has equal power to form bone, but is prevented from doing so, by its problem of blood supply. The arteries of the endosteum run inside the bone and are cut off by the forming bone, those of the periosteum which lays its bone down beneath itself, are not disturbed. Destruction of the nutrient artery makes conditions doubly bad for the marrow.

Compact bone, robbed of its blood supply, takes part in bone regeneration only after it has been renourished by ingrowing, eroding, granulation tissue. Then it takes an active part in forming bone by the osteoblasts of its haversian canals.

When used as a graft, Barth showed that the greater part of the cells die. Those on the free surfaces, epiosteal, endosteal and cut edges, survive and proliferate to form new bone. The tissue becomes vascularized and then in the new haversian canal new bone is deposited.

Through a series of carefully controlled experiments, Rhode has shown that bone is not formed through metaplasia in surrounding connective tissue. Where bone forms in unusual places away from other bone it is due to fetal rests or nests of undifferentiated cells which when given the proper stimulus take up the function of forming bone as osteoblasts, but normal inert connective tissue does not take up this function.

DISCUSSION

Dr. James David McCoy, Los Angeles.—Our essayist has brought out many important points relating to the regeneration of bone and has given us historical data of more than usual interest. We all realize that even today, in spite of encouraging advances in the science of physiology, many of the mysteries concerning the nature and action of bone are still unsolved. Experiments and observations carried on during the last twenty years have been extensive enough to establish the fact that bone is plastic and highly adaptive in nature; in fact, as early as 1767 John Hunter was so impressed with these two characteristics, i.e., by the way bone was built up one day and perhaps carried away the next, that he attributed to it a form of "consciousness." The observations he made on the neck of the femur established the fact that bone is being constantly renewed from infancy to adult life, and one hundred years later this fact undoubtedly gave Wolff the key to his "Law of Bone Transformation" which, as briefly stated by our essayist is "the amount of growth in a bone depends upon the need for it." That this terse statement explains the changes brought about through our efforts, will be apparent to any whose experience and observation have extended through any considerable length of time.

In considering the question of bone regeneration from the standpoint of orthodontists, I would like to call your attention to the work of two investigators whose findings have been especially helpful to us. Their work was quite different—one conducting a series of experiments showing definitely *the possibilities of bone regeneration;* the other showing the manner in which these changes occur under the conditions prevailing in our work. I refer in the first instance to Sir William Macewen of Glasgow, and in the second instance to Dr. Albin Oppenheim of Vienna. Dr. Macewen conducted a long and elaborate series of experiments for the most part on the canine species, all in the developmental period, with the idea of determining the relationship of the periosteum to the growth of diaphyseal bone. His experiments seem to prove conclusively that the periosteum has no osteogenetic function other than acting as a limiting membrane, and that the real factor in bone growth is concerned entirely with osteoblast. His experiments, largely verified by observations from his own clinical cases, indicate that the same possibilities of bone growth which were demonstrated in the long bones are equally possible in the bones of the skull, except that in the flat bone it is less vigorous than in the case of the diaphyses. This he attributes to the inherent protective power of nature, for he states that if in the case of a cranial fracture a large and vigorous callus should form, a pressure would result upon the cranial contents.

In speaking of the rôle of diaphyseal cartilage and its relationship to bone formation, he states: "In adult life regeneration takes place either through a transition stage of cartilage or by direct division of bone cells into osteoblasts. Where the conditions are most favorable, the osteoblasts are formed directly from the bone cell and ossification is hastened; but when the conditions are less favorable, the cartilage cell is formed and ossification is retarded. When cartilage does exist, the nucleus of the cartilage cell under certain conditions seems to possess the power of rapid proliferation and frees itself from its envelope by what looks like a process of absorption of the envelope without the intervention of osteoclasts, except under special circumstances, and also apparently without leucocytic phagocytosis. The nuclei thus set free are of the same form and size as the neighboring osteoblasts; they proliferate like them, play the same rôle and cannot be distinguished from them. The osteoblast is the embryonic or 'free form' of the bone cell, and once formed is capable of great and rapid proliferation; it has also the power of producing a matrix which becomes calcified. In repair of bone, a transitional cartilaginous stage is general, which is prolonged

if untoward conditions prevail, but under favorable circumstances the osteoblasts develop directly into bone without passing through transitional cartilage.''

At various times discussions have arisen as to the manner in which the length and breadth of bone occurs, some claiming that breadth takes place largely through the superposition of fresh osseous increments to its periphery, while the increased length of the long bone was accounted for by deposits at the epiphyseal lines. This, Macewen feels, inadequately explains these changes, for he states that ''bone is living, and as every living tissue requires renewal, absorption and repair must be constantly recurring processes throughout life. These can only be carried out through interstitial changes. It is true that in the depths of well-formed diaphyseal tissues, great and rapid interstitial changes are retarded owing to the mechanical resistance offered by the hard osseous walls. When stimuli are applied to bone, the cells in the interior proliferate and escape into the haversian canals and are carried peripherally into the first space suitable for their expansion, which is generally the subperiosteal areolar tissue. There they have room for further proliferation and may ultimately contribute to the breadth of the shaft. Such changes occur within a few days. While this is taking place, however, absorption of the calcareous tissue in the interior has begun, and areas of softening are formed. The conditions suitable for expansion prevail, space is provided for the proliferation of the osteoblasts which form interstitial growth in the interior of the shaft and may expand the bone peripherally.''

In discussing the great interstitial changes in bones during and after constitutional disturbances, Macewen states that ''in rickets the calcareous matter is absorbed during the period of ramollissement, afterwards it is redeposited, in some cases to excess, and a period of eburnation occurs. Shafts may be altered in shape, not merely by bending, but by remodeling. A shaft which was normally broadest anteroposteriorly may become broadest in the opposite diameter, which could not occur without fresh interstitial changes. These changes may take place with great rapidity. Within a couple of weeks of a severe illness, the bones of children have softened so as to be bendable and thus they participate in the systemic weakness which may be evinced by flabbiness of the muscles and general debility. During ensuing convalescence these same bones have become in a few weeks hard, active interstitial changes having taken place during both periods. Within a month or six weeks the calcareous matter in some instances has been absorbed, eliminated from the system, and a fresh supply has been ingested and redeposited. Interstitial changes in syphilitic osseous lesions are abundant, even in the interior of the shafts, rarefaction and redisposition occurring often, accompanied by increased thickening and weight in the bones. In certain forms of anemia absorption and thinning of the bones are greatly increased. The influence of certain chemical agencies and the effect of the secretions of certain glands of the body (pituitary, for instance), seem to have an influence on interstitial growth of bone.''

These observations relating to interstitial changes are of special interest to us now, in view of the facts being brought out by Dr. Howe and other researchers. Macewen further records the fact that the periosteum, while having no osteogenetic power, fulfills an extremely important purpose in acting as a limiting membrane to the osteoblasts issuing from the interior of the bone, and because of the abundance of blood vessels and lymphatics which it contains, aids in the nutrition and functioning of the bone cells. However, he states, ''The cells in normal growing bone, by their own inherent power, control their own increase and development quite apart from the periosteum. The form and size of the growing bone is governed largely from within, and only slightly, if at all, by its external covering, yet this covering on the other hand is responsive to osseous demands, elongating and widening as required. * * * As long as the physiologic action of the periosteum continues, it aids in moulding and retaining within bounds any plastic osseous effusion which may form on the surface of the shaft.''

In the final summing up of this work, Macewen enumerates among his conclusions that —''the continuance of the embryonal form of cell, the osteoblast, and its rapid proliferation, tends to increase ossific production. The longer it remains embryonal and actively regenerating, the greater is the tissue production. Any agent or condition which, while increasing and prolonging the proliferating power of the osteoblast, does not lower its vitality, will tend to increase the bone formation. * * * The younger the animal the greater is the

proliferating power of the bone cell, and the longer will it continue to proliferate before it assumes its mature form; consequently, the greater is the ossific production. * * * The bone forming power of animals of the same species varies. Not only are there marked individual differences, but there may be marked variation in proliferating power in the same year. For instance, the bone forming capacity is not equal during the whole adolescent period. In some months the osseous growth is extremely active compared with others, and during the former the proliferating potentiality of the osteoblast is exuberantly vigorous, while in the latter it is relatively feeble.''

In the memorable experiments of Oppenheim, which were made upon young baboons whose teeth were subjected to the various tooth movements under differing degrees of pressure, the reaction of the structures involved was clearly demonstrated. He showed that ''bone tissue, be it on compact or cancellated, reacts to pressure by a transformation of its entire architecture; this takes place by resorption of the bone present and deposition of new bony tissue; both processes occurring simultaneously. * * * The newly formed bony spicules are arranged in the direction of the pressure. * * * The entire transformation of the architecture and the orientation of the newly formed spongy bone spicules always occurs so characteristically and lawfully, that we may see by the histologic preparations in what manner the movements were accomplished. * * * This characteristic transformation results only upon the application of very slight, physiologic-like influences. * * * Should the force be too strong, the result will be such serious injuries to the periosteum, due to the disturbance in circulation, that there will be no typical reaction of the bony cells.'' In fact the characteristic changes demonstrated as always occurring under the stimuli of gentle pressure, are absent, which later led Oppenheim to the hypothesis: ''That there is some relation between the absence of new bony formation and the alteration of the blood vessels, i.e., the vitality of the periosteum is so far reduced that it is in no condition to respond and build new bone. These conditions, according to his belief, being the result of trauma, caused by too fast and intense tooth movement.'' It is very evident from this investigator's reference to the periosteum, that at least at the time of his experiments he still held to the belief that this tissue possessed important osteogenetic powers. However, it is also apparent that his object was not to determine this factor, but to learn the manner in which bone cells reacted under orthodontic pressure.

There are many phases in the study of the bone regeneration which are of interest to the orthodontist—in fact every consideration of it has a bearing upon our field, for in spite of the fact that the reactions which are brought about in our work do not place the heavy load upon the cells which bone surgery does, yet this is largely a matter of degree. In addition to this, we are favored by having our patients at a period of their lives when ossific growth is occurring in its most exuberant state, a fact which doubtless has come to our rescue many times and saved us from embarrassing situations. Tolerance of the tissues in childhood and youth is great, but we should not take advantage of this fact, but strive to treat these tissues with the care and reverence which they deserve. Only by such methods will the highest type of results be obtainable.

Dr. George A. Barker, Seattle, Washington.—I think you will agree with me that following such a scholarly, well prepared essay as Dr. Hitchcock has read to us, and such a wonderfully fine discussion of that essay, by Dr. McCoy, that there is very little left for me to say on the subject, especially, in an extemporaneous manner. I made a few notes here of the things that happened to occur to me, not having looked the paper or the discussion over beforehand, and it is possible that they were covered in either one or the other of these two.

Dr. Theodore H. Bass of Madison, Wis., did a lot of work, a number of years ago, and in his report, as given in the INTERNATIONAL JOURNAL OF ORTHODONTIA, ORAL SURGERY AND RADIOGRAPHY, I suppose you read it, a thought came to him, in thinking of the phase spoken of as orthodontia, that the development of bone as concerned with muscle stimulation, is covered somewhat in his experiments on ethmoid sections of embryo bats, showing that this bone, which has no muscle attachment, has a cell development, as he calls it, of bone cells.

There is much discussion as to just where the osteoblast and the bone cell differ in shape from each other.

One other thing that I thought rather pertinent, in my reading, was the fact that in the breaks of the long bones in children, the younger the patient the more apt the union was not to show after healing, that is, very faintly in radiographs taken in future years, you could scarcely tell that there had been a break. Perhaps this is interesting to the orthodontist in connection with the argument as to the time at which the orthodontic treatment should be instituted.

I believe Dr. Dewey made the statement that if periosteum is the origin of bone that regeneration could not be accomplished by orthodontic means, practically making orthodontia impossible.

I would like to have the doctor make some comment, if he feels like it, on an article that appeared in the *Literary Digest*, eight or ten weeks ago, on the possibilities of the use of the pituitary extract with reference to expediting the union of the bones after fractures and the possibility of stimulating the growth of bones concerned in the treatment of orthodontic cases where there has been at least a retarded condition in the development.

Dr. Carter.—Any further discussion? Does anyone wish to volunteer?

Dr. A. H. Ketcham, Denver, Colorado.—I would like to ask Dr. Hitchcock in regard to the red dye from the bran mash showing in the bones. Is that not an indication that the mineral in the bran was being supplied to the bones more than to the balance of the tissues? Suppose the red dye had a medium of some material which did not carry as much mineral, for instance, food without a mineral content, but still having the dye impregnated in it, would the dye show in the bones to such an extent?

Dr. Emmett Rixford, San Francisco.—I would like to say a word or two because this matter is very interesting to me. I want to compliment Dr. Hitchcock on his thorough way in which he has gone into the literature of the subject. A number of things were brought out in his paper which I was unaware of and I was pleased with his presentation.

I happened to have been fortunate enough to have been rather close to Professor Macewen, who has been mentioned by two speakers. I visited at his home and I have seen a large number of those preparations of dog-legs that Dr. McCoy mentioned.

One of Professor Macewen's greatest experiments was that of operating upon a boy who had lost his humerus from osteomyelitis, and it had been gone for a number of years, with merely the two ends left. Professor Macewen was doing some work in the correction of knock-knees and bow-legs and he saved the chips of bones he took out from these cases and he burrowed into this boy's arm, there was no periosteum there, he burrowed through between the muscles and imbedded those chips of bone into that trough and closed the wound. The bone chips grew and made solid bone. I saw the man about thirty years afterwards and he had a good arm. It was not a handsome arm, it was twisted and crooked, but it was serviceable and he was earning his living as a carpenter at that time. Experiment has shown that such chips surround themselves with cartilage and fuse together.

One statement made by Dr. Hitchcock suggested to me that possibly the Germans are rather prone to look upon vestigial rests as the cause of all sorts of things. That is the Cohnheim theory of the formation of cancerous tumors; i.e., the development from remnants of embryonal tissues in various parts of the body. To so regard bone growing in different parts of the body, as in muscles after injury, at a distance from other bones is rather a far-fetched theory and it doesn't explain many cases, especially of the diffuse form of myositis ossificans.

I saw in Europe, last summer, a little girl of three or four years of age whose muscles were turning to bone. The pectoral muscles, also the muscles of her arms, legs and back, in fact, almost every muscle of that little girl's body was generating a bone within its substance. Of course, this little girl cannot long carry on her life functions. The most interesting feature of the thing, however, was the study made by Professor Clairmont of her calcium metabolism. He found the calcium content of her blood was something like ten times the normal. That was a very important thing. Professor Clairmont tried to influence

the calcium metabolism by removing two of the parathyroid glands. He did not dare remove more because of the danger of fatal tetany. But the calcium content of the blood remained unchanged.

Another important factor is the matter of periosteum and its supposed production of bone. Possibly most of the confusion, or the discrepancy in ideas between the two schools, Macewen, on the one side, and Axhausen, on the other, whose ideas Dr. Hitchcock has so well presented, as well as Dr. McCoy, rests in the matter of a definition of just what is periosteum or what tissue you identify as periosteum.

Of course, we know that if a child receives a blow on a muscle, so that the muscle is bruised deeply, that muscle will often develop a bone. We have many instances of this.

I would like to tell of a case that I had only last spring, which may throw considerable light on this subject, and showing that it was due to a rupture of the periosteum that permitted the bone cells to go out, instead of being a new generation of bone in a muscle at a distance from the bone over which it lay. I have reference to a young lady who was riding horseback and bumped into a tree which struck her at the middle of the thigh causing a bruise. Three months after that she noticed a big swelling and the question came up as to whether it was a sarcoma. X-ray showed a deposit of bone in the crurius muscle. Operation revealed a most interesting situation. The crurius muscle was entirely replaced by bone. Some of the bone was adult bone with calcium and showed in the x-ray, but there was a great mass of bone which was new bone and not old enough to have deposited calcium at all. Bone likes to grow in muscle especially if bruised, but bone likes to grow in blot clot anywhere.

This might interest you, particularly, because of your operating upon bones by means of gradual pressure. A Swede by the name of Thoma, has developed an explanation for Von Recklinghausen's discovery that certain cancers produce bone. Thoma has developed a mechanical theory of it that bone, under pressure, will grow if the pressure is 6 gm. per square mm., if the pressure is greater than that, the bone will atrophy, as a wire will under pressure slowly go through a block of ice. If the pressure is less than that, the bone will be eaten up by cancer. That is, the mechanical pressure on the bone, produced by cancer, or conceivably by any other agency, will produce a growth of bone provided the pressure amounts to just a certain degree, a greater pressure causing atrophy. The growth of the bone, of course, is influenced by many morbid processes and each condition will bear close investigation as to the proper diagnosis and treatment.

Dr. Carter.—If there is no further discussion I will ask Dr. Hitchcock to close.

Dr. Harold Hitchcock, Oakland, California.—I have not much to say, in closing, but I want to thank the men who have discussed this paper.

It is well understood that pituitary stimulates bone growth. Dr. Robinson has shown that by expirements in feeding rats. He found that some rats would reach their full growth, although they were not much larger than the other rats of the same litter, at a more rapid rate.

Regarding the question of feeding madder—this depends more on the property of the dye rather than the medium in which it is fed.

ENDOCRINODONTIA

Lectures Read Before the Dewey Study Club

By Dr. David M. Kaplan, New York City

Lecture I

IN MEDICINE, more so than in any other profession, fads crop up from time to time, which temporarily engage the public's eye, and then, like a will o' the wisp, the flame dies, and the rage of a spell is relegated to the heap of antiquated ideas. What became of Twilight Sleep? Gone and forgotten is the much-talked of and well-advertised boon to motherhood. I am willing to believe that the future man will be permitted to live in peace with his tonsils and his appendix. I hope so, anyway. The medical profession is slow in giving up income-bearing fads, and for so long as the scalpel will draw blood the public will stupidly submit to the say-so of clever boosters of surgical or medical innovations.

Endocrinology came to us in a new and very stylish disguise, and for a time outshone its rivals. Romanticists wrote for hoi polloi, surgeons removed thyroids, and mere medical practitioners, helter-skelter, prescribed machine-gun remedies, containing, endocrinally speaking, everything under the sun. Hit or miss, there was something the patient was going to get, and often, alas, the patient got it!

We are at the present time giving endocrinology a great deal of attention, and are coming to the safe and sane level of logical criticism—and are robbing this internal secretory panacea of most of its superfluous notoriety. There are those who shout that there is nothing in it, and others, who are equally as eloquent, that it is an indispensable aid to all our ills. Both are deplorably in error. A sane conservatism holds the key to the solution.

We certainly can influence some diseased states with properly selected and judiciously prescribed internal secretory products. On the other hand, we must honestly admit that certain conditions, though presenting most definitely endocrine symptoms, nevertheless, cannot be influenced, and still less, cured, by endocrine drugs. As in every other special branch of medicine, we must attack disease in its incipient form, and not decry a method because it proves inadequate when advanced pathology is killing our patient.

Endocrine therapy never cured acromegaly, or Addison's disease, and never will. We will have given to suffering humanity a real service if we can detect endocrine ravages in the making, and diagrammatically speaking, repair the dam before it bursts. For that we need clever and experienced glandular engineers, who are technically properly equipped, and whose past performances vouch for their ability to detect defects and repair them.

Disease gathers momentum, at times so rapidly that it is often impossible to check its disastrous course. What would a parent have given, if a

doctor of repute could have foreseen an exophthalmic goiter in his pro tem healthy daughter, when proper prophylaxis could have repaired or eliminated the damage that followed?

Endocrinology will win its battles on the field of prophylaxis, and I hope that humanity will submit to its rather mild and unobtrusive ministrations with a willingness at least equal to that of removing tonsils or appendices.

Now, permit me to engage your attention with myths, near-truths, and facts, as they concern us tonight.

To blame any one single gland for the projection upon the clinical screen of the complete drama of any endocrine disease is pure mythology. To attempt to correct its pathologic course by means endocrinally indicated is only a near truth. To admit that advanced endocrine disease cannot be cured by endocrine methods alone is to admit a fact.

I shall endeavor to acquaint you tonight with the manifestations which follow when the pituitary is not functioning as it should. As you all know, the most glaring pituitary trouble is pictured as an incurable disease, and was described almost half a century ago under the nom de plume of acromegaly. "Acro" stands for distal parts, and "megaly" for enlargement; in other words, a "pathologic state characterized by enlarged hands, feet, cheek bones, jaws, teeth, etc." From all this meager description I will ask you to carry a still more meager conception, and just remember the word "megaly," or enlargement. We shall try to build upon this word a clinical-philosophic exposition which will give you plenty of opportunities to evolve for your own clinical minds the prophylactic adjustment that this word "megaly" suggests. And if not always, at least gratifyingly often enough you will be able to prove to yourselves that you possess something useful and concrete to combat other unnecessary and unpleasant objective and preeminently subjective complaints of your patients, aside from the "megaly" complex.

Whatever else it may signify, this enlargement so far means to us only a change in bulk, and as such we are going to accept it only as an index that something is wrong in the pituitary territory. Not only enlargement, but diminution in bulk is often a pituitary delinquency, and the term "acromicria" is by no means such a far-fetched designation of those peculiar people who earn a living in the circus as abridged editions of the genus homo. The little fellow, as well as the tall one, is a pituitotrope.

From what I have had to say so far I hope that you carried away just one pituitary appanage or peculiarity, and that is simply designated by the word "bulk." Change in bulk should always make you think of changes in pituitary activities, using the last word in its plural form, for the gland is concerned with more things than bulk, as you will see anon.

I can already detect here and there surreptitious glances directed at your neighbors, with a view to detecting pituitary markings. Search carefully, and you will find what you are looking for. But, having found one or two, you will admit that there is nothing the matter with them. Certainly not. Not yet. But a single sign to the wise is enough, and to overlook this in your patient is clinical myopia, and may prove highly disconcerting later on.

What a half grain of drug will do now, a pound will not accomplish when it is too late, and surely half a grain of an innocent remedy can do no harm.

We must not entirely depend upon single signs to establish an endocrine error. There is usually an ensemble which points to more than one gland, and as a matter of fact, no endocrine gland is in error without dragging in the rest of the glandular household. The endocrine equipment of the organism does not function separately, but like an orchestra, every instrument contributes its own sound, making an harmonious whole. An instrument may be out of tune, and give the sensitive ear an inkling that the rendition is not what it ought to be. The leader knows at once which instrument is at fault, and the instrumentalist betrays by facial expression or otherwise that he is out of tune. A slight adjustment and the harmony is restored. We must search for such objectivity in the human being, and by an early adjustment eliminate a glandular cacophony which when permitted to continue will ruin the entire ensemble. The error is at one time in the sound—and at another in the rhythm.

We shall endeavor to show you how rhythm in general is a department over which the pituitary holds peculiar sway. Patients who have sufficiently advanced with their definite pituitary disease, so that there is no mistaking the gland that is chiefly responsible for the manifestations, will give a history of having had in the very beginning of their disease a change in their periodic functions. Their sleep will be changed—they will be sleepy in the daytime and wide awake at night. In women the menstrual period will have changed in its timely regularity. Their appreciation of rhythmic sound will have altered, and in this connection, very often for the better. Ordinary laborers will develop a love for music. A patient of mine, who drove a team of horses for a coal company, gradually developed pituitary signs, one of which was of great significance to me, the ardor with which this man began to play the flute.

Of course, patients do not consult the doctor for slight cosmetic defects, nor would a truck driver consider himself any the worse for playing the flute, but to the doctor, and the endocrinologist in particular, these admissions are of paramount importance, and give him a clue to the identity of the real producer of the moving picture of his patient's discomfort.

To elucidate and properly interpret these seemingly irrelevant and immaterial admissions is to my mind the highest type of endocrine philosophy, and its timely recognition is bound to prove of service to suffering humanity.

Whereas menstrual errors may be attributed by the purely surgical logician to the gonads, errors in bulk and rhythm will indicate to the same surgeon, equipped with endocrine information, that primarily, or together with the gonads, the pituitary gland has to be reckoned with. The first doctor will attend to the uterus, tubes, or ovaries only, and reap a partial success, the sufferer still remaining a patient. The second doctor, bearing in mind the pituitary index, will combine with his knife his endocrine learning, and completely eradicate the trouble, and completely cure his patient.

Resting in its cradle, the sella turcica, about two inches behind the glabella, with an optic nerve on each side, the pituitary responds to the slightest change of intracranial vascularity. And as vascularity of any part of the

living body is an index of nutrition of that particular part, the pituitary gland, when its nutrition is interfered with, immediately sends out its peculiar SOS, in the form of temporary eye symptoms, or a supraorbital headache, or a menstrual manifestation. Mind you, the gland is not yet statically changed. It only objects to an unwelcome state of affairs, which can be removed with the greatest ease, and in a short time. But what will become of the pituitary when the doctor attempts to correct the eye strain with glasses, or the headache with aspirin, or the menstrual defect with the curette. The condition prevailing in the skull continues, the nutrition of the gland suffers, and the alteration in the structure of this organ takes place. Henceforth the individual is a distinct sufferer from a chronic pituitary disorder.

I hope that my address to you tonight will teach you how not to make such mistakes. Fortunately for you, as dental doctors, your field is confined to the hygiene of the mouth, but to my mind you ought to be equipped with endocrine logic as fully as the medical or surgical practitioner. It is for this reason that I am giving you information which would suit any doctor of medicine, as well as dental experts.

You may justly ask yourselves, of what good will all this pituitary information prove to our clients. I shall come to that directly.

Remembering the word "bulk," I shall start out forthwith with a question, "What has bulk to do with teeth?" And I shall answer, "Logically analyzing the anatomy of the skull, which is composed of two halves, any enlargement will have to take place laterally or centrifugally, and not centripetally. In such a case the statics involved will cause a seeming separation between the right and left side of the head, with an accompanying space, where the upper middle incisors are implanted." This is borne out by clinical data, and preeminently in acromegaly, where spaces between the upper two middle incisors are a rule.

But, gentlemen, acromegaly is a final product, and as such is irremediable. Spacing of teeth may be due to disease other than acromegaly, or it may be inherited, but it is a pituitary index in either case, and must be dealt with on lines peculiar to pituitary disorders. Together with the tendency to increase in bulk, generally speaking, the teeth, per se, take on in a measure an increase in bulk also, and as I have published in the past, are part of the general pituitary individual.* For the sake of brevity, such tendencies were spoken of then as tropisms, and the one under discussion now was designated at pituitotropism. It may be used synonymously with chemotaxis, tendency, predilection, etc., and as this exposition is written for purposes mainly therapeutic, I am leaving out those established pituitary conditions where it proved of little or no avail to attempt to eradicate the existing pathology.

Our field is the time period occupied by a prepathologic state of affairs, when it is still not too late to correct aberrations in the functional sphere, which are the precursors of static changes. In other words, our therapeutic attempts will be expended upon dynamic changes, which long precede those metamorphoses known to us through the postmortem route. We will cure disease in its tropic stage, before pathology replaces the microscopically nor-

*Journal of Endocrinology, April, 1917.

mal cellular arrangement. I say microscopically normal, because statically there is nothing wrong as yet, but chemically there will be found quite a change.

And this biochemical deviation from the normal can produce, and may be held responsible for most, if not all, the objective and subjective tropisms of the patient. Being still a chemical problem, and in a fluid state, we have not only the time, but also the means, to try to influence and change the diseased direction of the pituitary gland.

Adjustment at this stage is not difficult, and, attacked conservatively and mildly, often yields astonishing results. The eye strain corrects itself, the headaches disappear, the menstrual periods are reestablished as to regularity and duration. And all this, mind you, with a quarter or a half grain of the pituitary extract, once or twice daily; three or four days or a week produces a change, and then stop. Give nothing more. Let well enough alone; Nature will take care of the rest. You are satisfied that you have not "given your patient anything foreign, or too much, or for too long a time."

Will I be able to close up the space between the upper middle incisors, you ask. Maybe; and if not, at least you will have made your patient happier, and as proved by a longer observation of your case, you will have found with much joy that the tendency has been checked, that the grim spectre of unchangeable pathology has been removed, and you will have earned the lasting gratitude of your patient. All with a quarter or a half grain of pituitary extract.

I am by no means finished with my exposition of the pituitotropic man, woman, and child. Having studied endocrine manifestations since 1903, chiefly from the book of nature, unbiased, and wisely directed by my late friend and master, Dr. Joseph Fraenkel, a vista was opened to me full of a therapeutic hope, which the example of that genius amply furnished.

I stated previously that the pituitary is not functioning independently from the other members in the endocrine orchestra. You may have gleaned from my remarks that the gonads chime in whenever the pituitary is dynamically at fault. This is still more discernible when the gland is ontologically affected. In its milder display the young individual thus burdened may grow up to adolescence and riper age without attracting the attention of the casual observer. But he will never escape the scrutinizing glance of the well versed endocrine scholar. Not only the soma, but also the psyche obeys commands from the pituitary, and whereas the casual observer will miss the "Tekel upharsin" written on the patient's exterior, his peculiar social reaction will make itself felt and properly registered. To my mind the psychic twist, or change in character, is nothing more than a reflex, an endocrine reflex, and let me tell you that the endocrine system does most of its normal and abnormal business on a reflex basis. The rich pituitary has poor gonads for its neighbor. The poor thyroid lives next door to a well-to-do pancreas. Now, what do I mean by these remarks? Simply this: When the pituitary overworks, the gonads are checked, and when the thyroid is sluggish the pancreas can digest more carbohydrate than otherwise. The vita sexualis of the former is below par, and the carbohydrate metabolism of the latter is above the normal standard.

Antagonism and protagonism is preeminently an endocrine modus operandi. It is the doctor's task to select the aggressor and curb his ambition, so to say, or urge on the delinquent gland, and reestablish an equilibrium approaching perfect health. This can be accomplished, and has been done, but only after painstaking and honest search. The endocrine system being a chain, each link of this chain displaying a definite activity, we must endeavor to establish a balance of dynamic force consistent with the needs of the body.

Fig. 1.

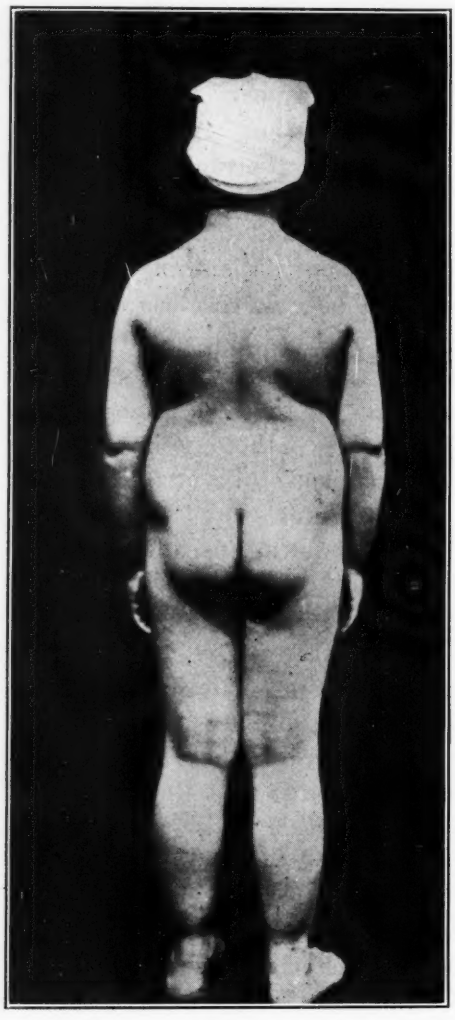

Fig. 2.

An Individual Is as Healthy as the Weakest Link in His Endocrine Chain.—This weakness may have been the result of an inherent—inherited anomaly, or may be secondary to an overbearing neighbor. I shall show you now what happened when the pituitary became overbearing and produced the clinical picture of adiposogenital dystrophy in the boy. The name itself would suggest to you what such a patient looks like. Adiposo, fat; genital, something about the gonads. Look at the pictures of the twelve-year-old boy (Figs. 1 and 2), and you will be spared the reading of a volume on pituitary disorders. If the patient should attain full age, and begin to function as a member

of society, will he not suffer from his peculiar make-up? Not only that, but gradually his soma will reflect on his psyche. His associations will become abnormal, and if his education and scholarly training were of the higher type you can very well predict in this individual the career of an Oscar Wilde. This boy is to be operated upon for a pituitary adenoma. His eyesight is being affected, and it was only for the purpose of saving his vision that the operation was advised. His adiposogenital misfortune will never be corrected.

There are many so-called normal people who have only a grain of the adiposogenital syndrome, and that grain is enough to make them peculiar. They think more of their clothes than the average, their conversation is on subjects related to Freudian theories, and they are forever hovering about sexual matters, with greater or lesser discretion. Their dreams are wish fulfillments, and replicas of their thoughts during the day. Of course, its pattern requires a psychoanalyst or medical dream interpreter for elucidation. The latter claim that they lighten the burden of their patient's abnormality, and thereby establish a more or less livable equilibrium. To all of which I say, "Maybe." What will I do, or what will you do, in such a case? I need not ask this question. The answer is plainly written in unmistakable terms on every face in this room. This is the time to introduce your treatment, and not wait until some jail, as in the case of poor Oscar Wilde, claims your patient as a prisoner. *Repair the dam before it bursts.* The Jack-of-all-trades, the morosoph, the superior degenerate, the ne'er-do-well, and many a criminal, find it as difficult to adjust themselves to the established law and order as the hen who is thrown into a lake. It is not the hen's fault that she cannot swim, and it is equally no choice of the delinquent extrasocial pituitotrope that he finds it impossible to conform to what the majority think is right. Many a bitter pill is swallowed in the home circle, and the world at large is absolutely ignorant of the petty drama enacted in the seemingly respectable boudoir. The final act or scene is usually found in the daily newspapers, and the endocrinologist sighs, "Another unfortunate one who could have been helped, and saved from this unwelcome notoriety, and the consequences which it entails." The hospitals, and not the jails, should be the proper place of refuge for these poor unfortunates, but by hospitals, I do not mean the knife. The horrible end of the sick Oscar Wilde ought to be an example potent enough to make public opinion think twice before sending such to Reading Gaol.

Sex is determined by somatic and psychic data. This psychosomatic ensemble is in perfect agreement with the sex of the man or woman in the majority of instances. Such people are to all intents and purposes normal. This state of normality exists for so long as the individual lives in an environment compatible with his somatostatic and psychodynamic equipment. Should he or she be called upon to rise to an occasion requiring more than their respective inherent somatopsychic endowment, they will be rendered deficient in general health for a shorter or longer time, depending upon their endocrine equilibrium. The same thing occurring in a member of society whose tropism is of the pituitary type, will cause the individual to react in a fashion peculiar to his tropism.

Firstly, the undue strain will produce a headache. Secondly, there will develop errors in vision. Thirdly, the vita sexualis will receive a check, and in the female the menses will stop. Should the thyroid be so adjusted in the latter instance that it will assume some of the pituitary work (as in the case of the man in the submitted photographs (Figs. 3, 4 and 5) a uterine hemorrhage will compel the woman to seek medical aid. You will examine your pa-

Fig. 3.

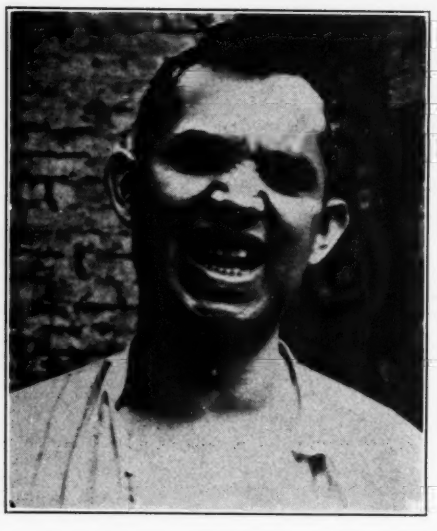

Fig. 4.

Fig. 5.

tient, and all you get after a thorough search is the admission of undue strain, and later, like pulling teeth, she will tell you that her wedding ring, which often slipped off her finger, can hardly be removed now, and that only when lubricated. You have found your index, and register at once "bulk." A few doses of pituitary, and the difficulty is often adjusted.

Uncontrollable habits, be they an addiction to drugs or tobacco, or alcohol, are in my opinion on an endocrine philosophic basis, all errors of rhythm. You remember the poetic expression, "The even tenor of his way"? Well, this even tenor is disturbed, and the culprit responsible lies hidden in his

sella turcica, like the criminal supermind, directing his activities from afar. You cannot remove him, for then a psychosomatic anarchy would follow, worse than the affairs preexisting his removal. But you can curb him, by introducing an animal's pituitary. That will do the work—real pituitary work, as it has done for the animal it came from.

The habitual drunkard, in the early stage, can be influenced for the better, but permitted to go about, such an individual loses his morale, and with it his will power, and becomes gradually less amenable to therapeutic efforts. The Bible had such delinquents in mind when it spoke of visiting the sins of the fathers, even to the third and fourth generation. If it is not one endocrine defect, then it is another, but their progeny suffer from a parental stain that can only be controlled by endocrine methods.

Drugs and alcohol, being nothing more than chemicals, with peculiar qualities, are acceptable to the man or woman with a pituitotropic constitution, and only a pituitotrope will be unable to say NO, when a pernicious habit offers its venom in the disguise of a stimulant. The system that suffers is the one closest to the chemistry of the substance taken, and the endocrines, being the chief chemists of the body, naturally suffer most, and produce a psychosomatic change, with which every one is acquainted; the copper nose and flushed features of the drunkard, with his irrelevant loquacity, and the pasty skin and glassy eye of the drug addict, with his suspicious attitude and low moral tone.

I could dilate *ad infinitum* upon these interesting themes, but I know you are anxious to have some questions answered, so I shall continue in my next lecture with the pituitotropic appanage of the vita sexualis.

ENDOCRINODONTIA

LECTURES READ BEFORE THE DEWEY STUDY CLUB

BY DR. DAVID M. KAPLAN, NEW YORK CITY

Lecture II

IN THE architecture of the male and female soma and psyche, Nature was, apparently, not very particular in assorting the static and dynamic material at hand, the result being a more or less mixed sexual being, containing a little shred of the male in the female fabric, and a few female remnants in the male. The male infant spends his first half dozen years no different from any girl, and his parents accord him the attentions of a female child.

Nature saw fit to make the female more important than the male, for she is the one who is responsible for life's most significant urge, the destiny of living nature. The preservation of the race is left to her functions, and it is only through economic forces that man found it convenient to place her industrially below him. Socially, economically, and therefore artificially, man is superior. Naturally and ontologically woman is, and always will be, of more importance than the male. Nature works through her, while the social direction is left to man. Work out for yourselves, the queen bee—and her place in nature—and the rather secondary activities of the drone.

It is difficult to teach the subject of endocrinology without evolving a philosophy which is logically concordant with *a priori* conceptions of the laws of natural phenomena.

If statically altered pituitary glands, in the yet unripe and underdeveloped male, tend to furnish him with a quota of femininity, easily recognizable even by the uninitiated, we must grant that this gland, among its other functional expressions, is capable of foisting female characteristics upon the male. The extent of this femininity in the male depends upon the functional trend his pituitary has taken. It may be at times so marked as to give the male a mammary equipment entirely out of proportion with his cosmetic needs. In medical literature one finds even such extremes, freaks of course, who upon the death of the mother were fully capable of nursing the surviving infant. The endocrine history of these wet nurse males is not extant, but I venture a guess that they had the ear-marks of the pituitotrope type, such as the boy, whose photograph was observed at a previous lecture.

Although bulk and rhythm were spoken of before, as indices of pituitotropism, there are a number of other signs which enable the endocrinologist to determine the trend of his patient's make-up. For this purpose it is best to arrange the salient features in table form, under the heading of hyper- and hypopituitarism.

HYPOPITUITARISM

Adiposity.
Fat pads around malleoli.
Fatty accumulations—upon buttocks and neck.
Lowered basal metabolism.
Increased tolerance to CH_2O (remember pancreatic overaction).
Slow pulse (thyroidal sluggishness).
Subnormal temperature (hypothyroid).
Infantile uterus.
Irregular menses.
Sterility and amenorrhea.
Small, underdeveloped or atrophied gonads.
Mammae overdeveloped, male and female.
Arrested skeletal growth.
Retarded vocal development.
Fatigability.
Polyuria.
Gas.

The phenomena tabled above amply prove the functional entente that exists between the endocrines. It seems that when the pituitary is working sluggishly the thyroid is to a large extent a partner in this half-time work. The adrenals are influenced, as a result of the general lowered metabolic rate, and by their dormancy add the factor of fatigue to the general hypopituitary ensemble.

HYPERPITUITARISM

Nose thickened (see acromegaly).
Prominence of superciliary ridges.
Tendency to square terminal phalanges.
Enlarged tongue in advanced cases.
Thickening of lips.
Pregonadal gigantism; later bone deformities.
Widely spaced teeth.
Enlarged sella turcica.
Thickened skin.
Hypertrophied nails.
Short square hands.
Diminished CH_2O metabolism.
Impaired vision.
Amenorrhea.
Headaches.
Increased basal metabolism, as a thyroid concomitant.

The difference between hypo- and hyperpituitary states is explainable on a thyroidal basis. Where this gland, being inadequately equipped, gives the impetus which makes the giant and acromegalic you may judge for yourself the importance of the pituitary function, in so far as the preservation of

the race is concerned. If menstruation is to be considered as a sine qua non of fertility, you will have learned from the above given table that whether hyper- or hypofunction stigmatizes your pituitary, conception, on account of the amenorrhea, is highly improbable. Aside from traumatisms, infections, or neoplasms of the gonadal reproductive departments, in my mind, all menstrual abnormalities are preeminently endocrinal phenomena, and principally of pituitary origin.

Ordained by nature to be the biologic timekeeper, the altered pituitary simply does not keep time, and the gonadal functions male or female, are out of time and out of rhythm. The vita sexualis is markedly influenced, and the eros becomes gradually extinguished. The male, loath to relinquish this function, begins to reminisce upon the ruins of extinct excitement, develops a morose and misanthropic worldly attitude which estranges him from his friends. His female pals drop off, for reasons best known to them, and as the cause of this tragedy dawns upon his mind life becomes a burden. He consults the doctor, who prescribes cantharides and other aphrodisiacs. He is peppered up for a spell, only to sink still deeper into the quicksands of pituitogonadal abyss. He becomes a candidate for addictions, and selects either drugs or alcohol. If his mind is superior to the comedy Nature is playing with him he seriously contemplates suicide, and some such unfortunates succumbing under the strain gather enough courage to speed the bullet through the skull. Handled properly, in the very beginning, the enlightened doctor can do much by way of endocrine therapy, together with psychoanalytic efforts.

The female, however, is not affected so disastrously, and gently submits to the change without making an end of it, as in the case of man. She is curbed by conventional injunctions which restrain her emotions like a straightjacket. And whereas all the equipment, somatic and psychic, are glaringly present, the social ban shuts the outlet. Woman, from the dawn of history, and up to date, has been taught to curb her emotions, and consequently suffers as much, if not more, but hides it far better than any man.

Writers upon endocrine subjects have paid very little attention to the psychic involvement in endocrine pathology; the irritable and prevaricating, basedowic, or hyperthyroid individual, the boasting gonadotrope, the stubborn and assertive adrenotrope, and the lascivious, at times obscene, pituitotrope. The pituitotrope is the man who is plentifully equipped with a large repertoire of risqué stories.

Though every one of us, normal and healthy men and women, can be more or less tropically designated, our protagonisms and antagonisms, endocrinally speaking, as a rule are well balanced, with just enough of a difference here and there, or in this gland or another, to make us what we are.

There is no doubt that we are dominated by our endocrines. During infancy it is the thymus that carries us over this upbuilding or constructive period. As soon as the structure is complete the thymus bids us farewell and leaves the human edifice to the government of the gonads. The gonadal period is the longest, and during its administration the integrity of the race is assured. As the gonads gradually cease to function the soma and psyche

of man are dominated by the adrenals. During all these periods the thyroid, pituitary and pineal glands serve in an ex-officio capacity and lend their policy to individualize the individual. One has more, and another has less of the thyropituito, or pineal influence. The first three glands may be designated as the dominant group, the last three as the determinant group. One or the other of the determinants may step in for reasons not as yet established, and direct the life of the person. On the other hand, the one or the other of the dominants may be so powerfully endowed ontologically, as to give its stamp to every psychical and most of the somatic trends of the human being. There are some who are persistently juvenile, because of a thymus which still acts, and others excessively gonadal up to seventy, for the same reason on a gonadal basis. And some get to be prematurely old and gray, because of adrenal overaction. The determinant group decides the amount of bulk the individual shall have, through pituitary influence on a somatic basis, and vita sexualis on a psychic basis. The speed with which the entire array shall function is established by the thyroid. The pineal was found to introduce a psychosomatic gonadal precocity in a few instances of adenoma of this gland, and hence, when we are confronted by the precocious pet of the family, as endocrinologists, we will tentatively hold the child's pineal responsible for the precocity. All these peculiarities are still in the domain of normalcy, devoid of uncomfortable experiences, and may be the doctor's friends, relatives or acquaintances, but not patients. If his endocrine vision is clear enough he may pick out one or two, who in the future will consult him, but it is not good professional taste to apprehend such tropic people and foist upon them today what they will not require until tomorrow. That is why the majority of definitely endocrinally encumbered patients present themselves for their glandular correction in a stage at times so advanced that only with the greatest difficulty and painstaking analysis can the doctor afford to promise even a slight improvement. It will never be different, and on account of such unsolvable riddles endocrinology will hover between exact science and faddism.

To return to our subject of dental endocrinology. Knowing to what extent the female gonads influence the dental apparatus, it is the paramount duty of the dentist to inquire into the functional integrity of these structures. The mineral content of the teeth is safeguarded by a healthy thyroid primarily and healthy gonads secondarily. The discussion of this topic will be fully covered when I shall speak of the thyroid gland, and I now touch upon it only as a topic which concerns the pituitary in its rhythmic control of the gonads. But it is indispensable for the dentist to know how his patient's pituitary functions before he can give a full amount of service in the shortest possible time. How often does a first-class dental doctor find that he has to go over the entire gruelling task of months at hard labor, mental and physical, just because the pituitogonadal equipment of his patient has altered the statics of his or her mouth. Had he known this and corrected it before, he would have saved himself and the client labor, time and expense.

I most sincerely hope that you will all know this before I get through—at least I shall not consider these lectures as finished unless you do know. In your special branch of orthodontia, more so than in the other dental specialties, endocrinology is an indispensable adjuvant, and I believe it is this necessity which prompted you to honor me with the request to lay before you my experience in endocrinology of the past twenty-five years. One is bound to be grateful for such an opportunity, but unless you prove to yourselves and your patients that through the stimulus given you by my remarks your good results have greatly increased, it will be to me only a half-gained victory.

Bearing in mind the remarks upon the tropic designations of people, I shall give you a few diagrammatic instances of such a classification of well-known individuals. Theodore Roosevelt was preeminently a pituitoadrenal type. On the other hand Woodrow Wilson was pituitogonadal. If you are only superficially acquainted with these historical characters, and just bear in mind their activities, you will find the activities of the former on the African veldt and in the South American jungle, while the latter was a leader in the salon. You may assign for yourselves the tropisms of Tolstoi, Victor Hugo, Darwin and Einstein, and again De Maupassant, Byron and Walt Whitman. I am purposely omitting such extremes as Rasputin, Oscar Wilde, Zacher-Mazoch, Brigham Young, Rosa Bonheur, Mary Baker Eddy, Benvenuto Cellini, and others. They are the opposites of men and women like Savonarola, Garibaldi, Abraham Lincoln, Francis of Assisi, Edith Cavell, Queen Victoria, etc.

I have not the least doubt that every one of the above had their endocrine problems to solve, and did not require the doctor's aid to solve them; with a few exceptions, like Oscar Wilde, with his pituitogonadal tropism, who had to be cured by law, and from the other camp, Savonarola, with his pituitoadrenal overbearing, who got himself burned at the stake. The pituitogonadal man always attracts the opposite sex, much more so than the pituitoadrenal male. Being such an individual, Brigham Young included the trend in his theologico-political conception of Mormonism. Dowie, or as he styled himself, Elijah III, came to New York with train loads of women. So marked was the gonadal tropism of the founder of Mormonism that in order to safeguard his peculiar endowment he made it part of his religion. Dowie, on the other hand, having discovered that his adrenal glands were beginning to assume the management of his endocrine household, began to preach his New Zion ideas and thus succeeded, at least vicariously, at keeping himself in the public eye, his particular adherents being females.

The younger man whose gonads are tropically on the wane establishes for himself a Sir Galahad ideal, and for the lonely female of his choice a Madonna-like existence. I am treating such a patient now, and will give you more about this subject when the gonads will be discussed.

The pituitary had done its work, in a measure compatible with the demands of law and order from a social viewpoint. From a medical aspect one sees them suffering from one complaint or another, very frequently misinterpreted and inadequately treated. I spoke of the supraorbital headaches occurring in

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Nevertheless, surgeons advised him to be operated upon. This is one of many instances of vicarious function, assumed by a gland to maintain a livable equilibrium, but only endocrine knowledge will open the eyes of the eager surgeon and forestall a catastrophe such as happened to the poor unfortunate shown in the photograph.* He died eight months later from a vasomotor collapse, due to a much reduced blood pressure.

The study of a patient of the above type shows you that another factor must be reckoned with in making an endocrine diagnosis, and chemistry of late gave us much to think about in solving some internal secretory puzzles. This will be discussed in treating of the thyroid, adrenals, and pancreas.

In many pituitotropes one finds a rather frequent gastrointestinal symptom in the form of uncontrollable gas formation. There is a distinct type of flatulence which is purely pituitary, and not caused by CH_2O fermentation. I have had opportunities to observe such patients, and found that even the total abstinence from food for seventy-two hours did not remove this inconvenience. Based upon the tropism of these patients, which was distinctly pituitary, I gave them small doses of this endocrine, and had extremely gratifying results in a few instances. The percentage of cures, however, was not

*See Lecture I, page 49.

I most sincerely hope that you will all know this before I get through—at least I shall not consider these lectures as finished unless you do know. In your special branch of orthodontia, more so than in the other dental specialties, endocrinology is an indispensable adjuvant, and I believe it is this necessity which prompted you to honor me with the request to lay before you my experience in endocrinology of the past twenty-five years. One is bound to be grateful for such an opportunity, but unless you prove to yourselves and your patients that through the stimulus given you by my remarks your good results have greatly increased, it will be to me only a half-gained victory.

Bearing in mind the remarks upon the tropic designations of people, I shall give you a few diagrammatic instances of such a classification of well-known individuals. Theodore Roosevelt was preeminently a pituitoadrenal type. On the other hand Woodrow Wilson was pituitogonadal. If you are only superficially acquainted with these historical characters, and just bear in mind their activities, you will find the activities of the former on the African veldt and in the South American jungle, while the latter was a leader in the salon. You may assign for yourselves the tropisms of Tolstoi, Victor Hugo, Darwin and Einstein, and again De Maupassant, Byron and Walt Whitman. I am purposely omitting such extremes as Rasputin, Oscar Wilde, Zacher-Mazoch, Brigham Young, Rosa Bonheur, Mary Baker Eddy, Benvenuto Cellini, and others. They are the opposites of men and women like Savonarola, Garibaldi, Abraham Lincoln, Francis of Assisi, Edith Cavell, Queen Victoria, etc.

I have not the least doubt that every one of the above had their endocrine problems to solve, and did not require the doctor's aid to solve them; with a few exceptions, like Oscar Wilde, with his pituitogonadal tropism, who had to be cured by law, and from the other camp, Savonarola, with his pituitoadrenal overbearing, who got himself burned at the stake. The pituitogonadal man always attracts the opposite sex, much more so than the pituitoadrenal male. Being such an individual, Brigham Young included the trend in his theologico-political conception of Mormonism. Dowie, or as he styled himself, Elijah III, came to New York with train loads of women. So marked was the gonadal tropism of the founder of Mormonism that in order to safeguard his peculiar endowment he made it part of his religion. Dowie, on the other hand, having discovered that his adrenal glands were beginning to assume the management of his endocrine household, began to preach his New Zion ideas and thus succeeded, at least vicariously, at keeping himself in the public eye, his particular adherents being females.

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*See Lecture I, page 49.

sufficient to make me overconfident that I had a perfect weapon to combat this particular flatulence.

I must now advert to something which our training looks down upon, for I found the drug which supplemented the pituitary pill most admirably. Having had some experiences with homeopathic drugs, I found that lycopodium not only removes gas, but that the proving of this innocent remedy fits remarkably well most pituitotropes. From now on I claim that in this condition, no allopathic prescription fills the therapeutic requirement so completely as Lycop 3X. It will be my pleasure to disclose to you as I go along some of the homeopathic equivalents among the endocrines, and open to your therapeutic vision a new territory, full of interesting possibilities.

It is quite an interesting observation that most cryptic pituitotrope sufferers more than occasionally show a predisposition to form gas, and regardless of allopathic medication, diet, or physiotherapy, retain their complaint. It is perfectly astonishing in how short a time this gas can be influenced in the pituitotrope by means of a dozen tablets of Lycop 3X. At the final lecture I wish one of you gentlemen would remind me to give you a list of drugs with their endocrine and homeopathic indications. In this particular equipment, and its practical application it will be a distinct pleasure to me to cooperate with you.

My remarks to you, gentlemen, are chiefly designed to make you think endocrinally, for to give you clinical data, at best only incomplete, it would require many, many more evenings than your time and mine permit. I believe that you have at this early date enough pituitotropic data to apply your knowledge successfully on well chosen patients. The spaced teeth, the square teeth, teeth with little discoloration on the occlused surface, the prominent lower jaw, will give the dental endocrine tropism you desire, and the body in general will supplement your dental information. You will also not forget that the endocrine system is an orchestra—well attuned, and in harmony with the needs of the body. The trifle more in one gland, and the atom less in another, make us blondes or brunettes, hasty or phlegmatic, normally obese, and normally lean. All of us here belong to an arrangement such as this. Only when an endocrine begins to dominate the other members of the orchestra does a disharmonious state of affairs ensue, and of course the patient calls on the doctor for help.

Before closing this pituitotrope chapter, I wish to call your attention to the subject of fatigability. At the Plattsburg officer's training camp many young men were found deficient in their endurance. Upon a close examination an endocrinologist found that there are two kinds of fatigue, one associated with adrenal insufficiency, in dark complexioned individuals, hairy and wiry, the other kind displaying the bulk of good muscles, but flabby and pouchy at the axillae, their pubic hair as a rule having a female distribution, with the apex pointing downward, and their gonadal vita not complete. Their fatigue is due to a poor pressor principle in their pituitary gland.

I presume you know that the pituitary possesses a powerful pressor principle which displays its activity in the gonadal territory. The uterus cannot expel the fetus without it—and pituitrin is often used in cases of dystocia.

DEPARTMENT OF
ORAL SURGERY, ORAL PATHOLOGY AND SURGICAL ORTHODONTIA

Under Editorial Supervision of

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THE SURGICAL-ORTHOPEDICAL REMOVAL OF THE DEFORMATIONS OF THE JAWS*

By Christian Bruhn, Düsseldorf, Germany

Read by Ferdinand Gutowski, Dr. med. dent., Schwaeb. Gmünd

As war brought many diseases and wounds in the jaws, we were obliged to create several special hospitals, where the dentist could work together with the surgeon.

Gradually a new sphere of medical and dental science arose, and soon a new system became possible.

Thus a new way was found to remove the deformation of the lower jaw, especially of the so-called macrognathy and micrognathy.

The accompanying illustrations will demonstrate this new way in two methods, which were employed in Prof. Bruhn's Westdeutscher Kieferklinik.

On the outside the makrognathy may be observed by the prominence of the chin. It disfigures the human face and produces an unharmonious, even repulsive expression. The curve of the lower jaw reaches far beyond the upper jaw.

In general there is a more or less large space between the front teeth of both jaws, measured in the horizontal line. If the jaws are closed the lower incisor teeth will cover the upper teeth totally or for the most part. The lower molar teeth are tilted inwards by the unusual bite of their antagonists. Macrognathy is generally caused by natural disposition or by inheritance. It begins with unusual dentition. The lower front teeth appear before the upper front teeth, so that early forces are working which will press the lower jaw forward. According to Brophy (*Oral Surgery*, 1917), the chief cause is, that the articular ligaments have become loose and allow the lower jaw to move forward.

*Read before the First International Orthodontic Congress, New York City, August 16-20, 1926.

If the front teeth of the lower jaw appear before the front teeth of the upper jaw, the lower jaw will be pressed forward more and more and thereby the broader back part of the lower jaw will face the narrow front part of the upper jaw. The bite, therefore, will be directed towards the inner cusps of the lower molar teeth, which thereby will tilt inwards; simultaneously the jaw will turn so that its lower part will be pressed outward. Meanwhile the curve of the lower jaw will gradually grow, as it is no longer possible for the upper jaw to hinder this increase. Thus the makrognathy of the lower jaw develops from the time when the front teeth change and the first molar teeth break through, to the time of puberty.

In an advanced grade of macrognathy, orthopedic means will not be sufficient. Here surgical and orthopedic treatment alone can succeed. In

Fig. 1.

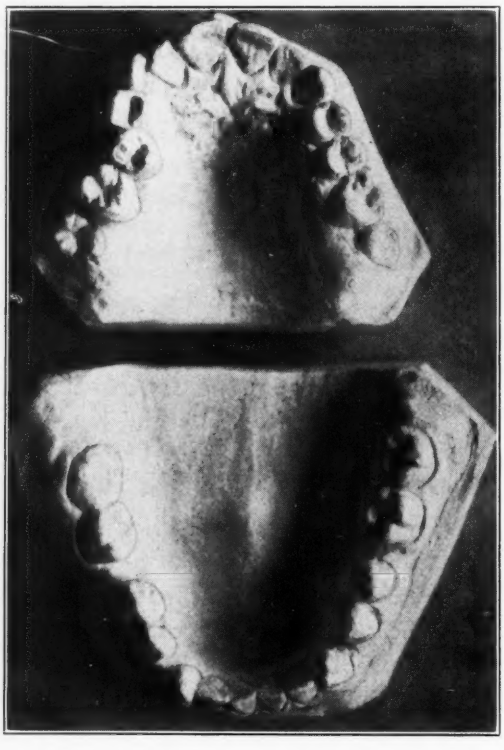

Fig. 2.

every surgical treatment known in literature a cut is made through the inferior maxillary bone and the parts fixed afterwards.

It is natural that the choice of the cutting line is very important for the healing.

When traumatic disturbances of movement appear, the ascending ramus is cut between the foramen mandibulare and the incisura semilunaris, because here it is not necessary to open the oral cavity. Therefore the same place is chosen to remove the macrognathy. Especial orthopedic care is shown in selecting this cutting line, because here the bow of the jaw remains a unity, which may be removed to the bow of the upper jaw. Thus the cutting of the nervus mandibularis and of the arteria inferior is avoided, while

the wounding of the nervus facialis is hindered by cautiously cutting from the lower backside to the upper frontside. We advance from the earlap to the maxillary bone, cutting behind the parotid gland. The maxillary bone is denuded near the periosteum and sawed through slantingly between the incisors and the beginning of the canalis mandibulare.

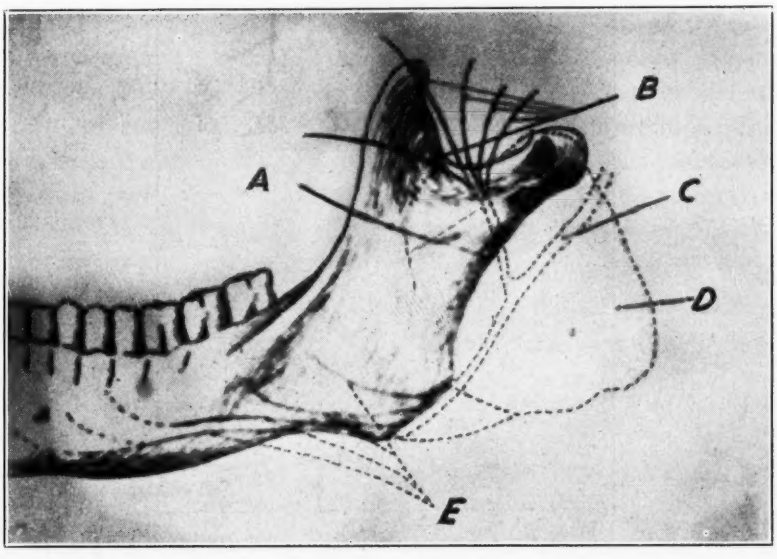

Fig. 3.—*A*, saw-cut; *b*, upper facial branch; *c*, facial trunk; *d*, gl. parotis; *e*, n. facialis.

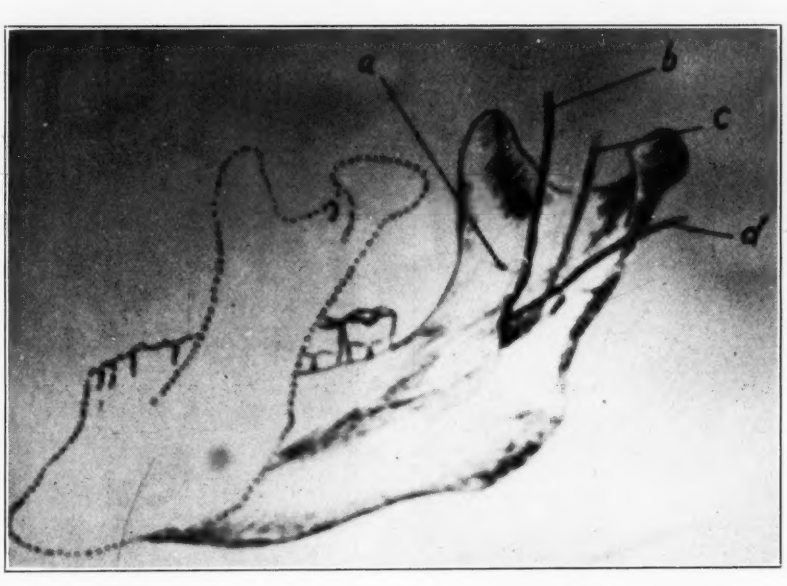

Fig. 4.—*A*, saw-cut; *b*, n. mandibularis; *c*, a. mandibularis; *d*, v. mandibular.

In general the cutting-line gives us nearly a rectangle to the axle of the processus condyloideus; it cuts the inner and outer flap of the ascending ramus in the same elevation.

The orthopedic treatment resulted from the treatment of fractures. As a ligature, an especially strong thread is employed, which in the upper and lower jaw is put entirely around the teeth; it is provided with little hooks

which in the upper jaw are turned upward and in the lower jaw are turned downward. In some cases the teeth are better taken by an uninterrupted cap. The intermaxillary fixation is reached by strong thread ligatures.

Fig. 5.

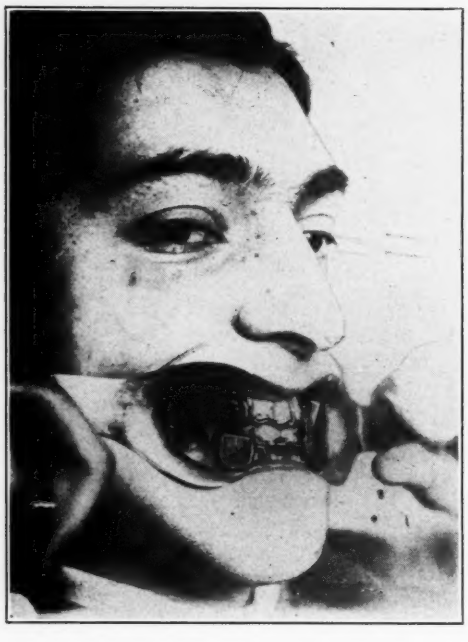

Fig. 6.

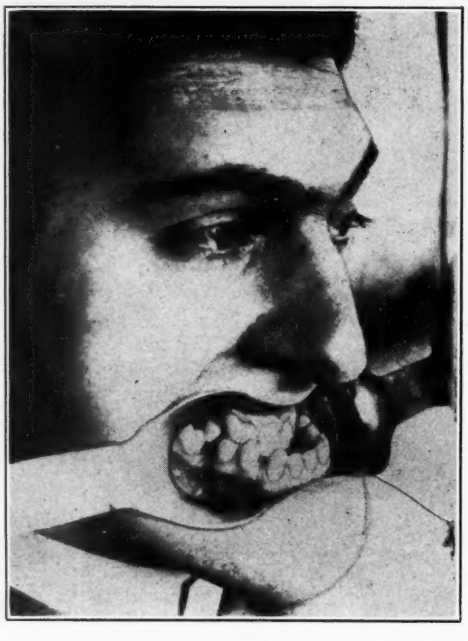

Fig. 7.

The inclination of the lower jaw to press forward again will be hindered by a slide guide closed at the front. The stiffness of this apparatus, however, often aggravates the bending of the intermaxillary ligatures.

Fig. 5 shows a man about twenty-two years of age with macrognathy.

We see a striking development of the lower part of his face. The prominent chin appears very sharp; the under lip is before the upper lip. Since his sixth year the patient has had an especially strong increase of the lower jaw, which, beside the disfiguring of the face caused disturbances in speaking.

The inspection of the mouth shows a strong and well-preserved set of teeth. The lower jaw is abnormally developed. While the teeth of the upper jaw are pressed, the teeth of the lower jaw are interrupted. The extraction of the first molar left a gap between the second bicuspid and the second molar. Between the canine and the first bicuspid there is also a space on both sides. The front teeth of the lower jaw stand about one finger breadth before the upper front teeth. In the upper and lower jaw large thread ligatures were made, which should hold the lower jaw in the normal position in

Fig. 8.

relation to the upper jaw, to remove the progenia. Under local anesthesia the ascending ramus was sawed through subperiosteally by a small cut from the earlap, sparing the mucous membrane of the mouth. On both sides the nervus facialis was spared. We succeeded in moving the lower jaw so much that nearly normal articulation was achieved.

Fig. 7 shows how both jaws are strung together by strong thread ligatures.

The radiograph (Fig. 8) clearly shows the cutting line of the ascending ramus, as well as the fixation of the lower jaw by the thread ligature, which was fastened to the two molars by anchor bands. After three weeks the patient could be dismissed.

Three weeks later the thread ligature was removed. The mouth could be opened normally, and the patient was able to chew without complaining; the teeth were in moderate articulation.

Fig. 10 shows the result in profile. The comparison before and after the treatment is remarkable. Now the finer correction of the position of the teeth could be made, especially the stretching of the upper jaw, which would make correct articulation possible.

Figure 11 of the progenia shows a prominence of the upper jaw. The latter may be a real one in proportion to the other parts of the face caused by too large an upper jaw or by its protrusion, but it may be also a seeming one, if it results from an underdevelopment of the lower jaw, called mikrognathy.

There is a difference between an innate micrognathy of the lower jaw and a micrognathy which has arisen during the period of development. As to the latter there are generally early disturbances of a traumatic or inflam-

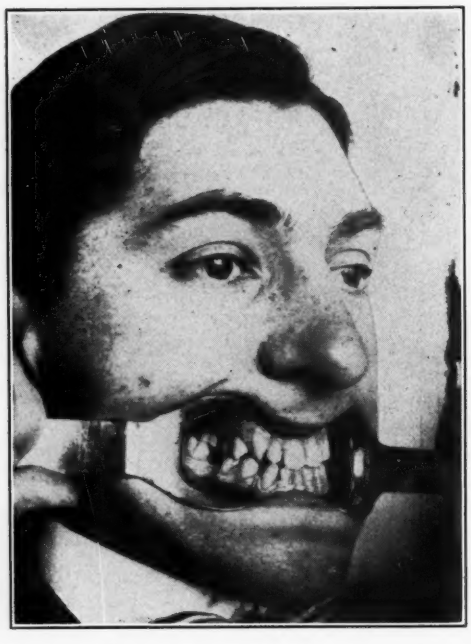

Fig. 9.

Fig. 10.

matory kind in the region of the maxillary joints. Thereby a continual limitation of the movement of the jaws (lock-jaw) is usually caused. If the disturbance has not this motive, there are often damages in the center of the ossification or disturbances of the development during the shedding period, which cause the arrest of growth of the lower jaw. To remove the micrognathy of the lower jaw, its horizontal ramus must be cut through on both sides. The lower jaw, loosened from the connection, is fixed in this position till bone clasps are planted from the crest of the ilium.

Fig. 12 shows Bruhn's extension apparatus. It consists of a strong head-bandage. On a curved double splint, which is fastened there, Bruhn's extension-forceps are movably arranged.

By applying a cap bandage on the teeth of the upper jaw the position of the extension apparatus is better fixed. Bruhn's extension-forceps consist of

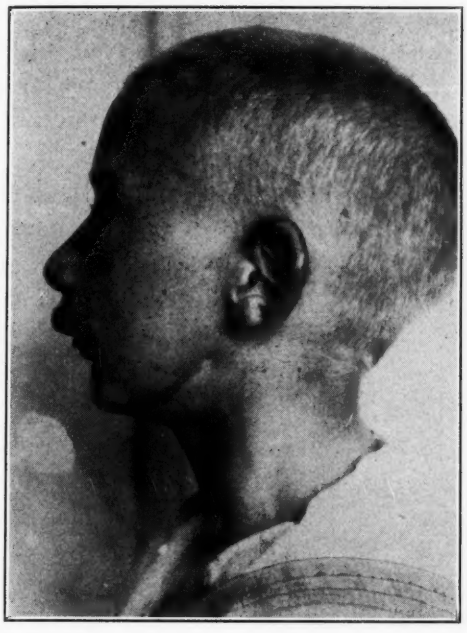

Fig. 11-*A*.

Fig. 11-*B*.

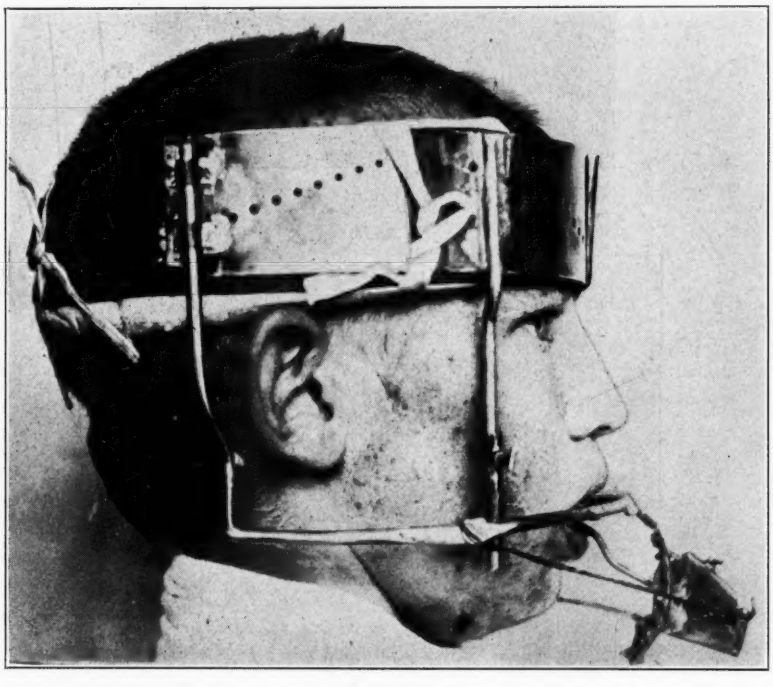

Fig. 12.

two blades; the first has a hook, the tip of which grips far back. The second blade is so curved that it can enter the mouth above the under lip. This blade has on its end a cap, fitted for the teeth of the middle part of the lower jaw. The blades of the hook and of the cap are in shells, from which they can be removed in any length. These shells are so combined by a joint, that they can be clapped up and down, and thus the hook and cap can be made to

approach each other. Their fixation is made by an adjusting screw. A flat metallic little chest, which is put over the shells, prevents each movement of the arms to the sides. The union of the head-bandage with the forceps takes place by a tag, which is put through one of the holes of the little metallic box.

The horizontal ramus of the lower jaw is cut through between the first bicuspid and the first molar. After anesthesia, due to loss of nerve conduc-

Fig. 13.

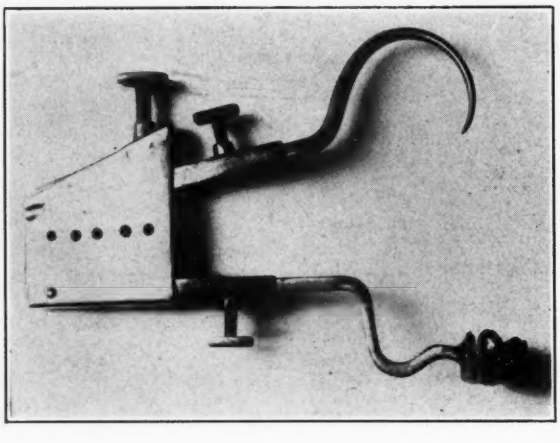

Fig. 14.

tion, advance is made through a little cut from the edge of the lower jaw. We endeavored to prevent injury of the oral mucous membrane, but it cannot be totally avoided, because here the soft parts lie next the maxillary bone above the duplicature. The site of incision was overstretched on both sides, then the extension-hook was placed near spina mentalis, the cap of the upper forceps-blade was fixed on the teeth and the forceps were closed. The cen-

tral portion, loosened from its attachment, is drawn forward and fastened in this position to the hoop which is hanging down from the head-bandage.

Some days later the middle of the lower jaw was drawn forward still more and fixed by a displacement of the little tag. The wounds in the mouth

Fig. 15.

Fig. 16.

were totally healed after four weeks, so that on both sides of the site of the incision a fragment of bone, one inch in length, from the crest of ilium could be inserted.

The result after treatment and after the removal of the extension apparatus four weeks later is shown in Fig. 16.

Fig. 17.

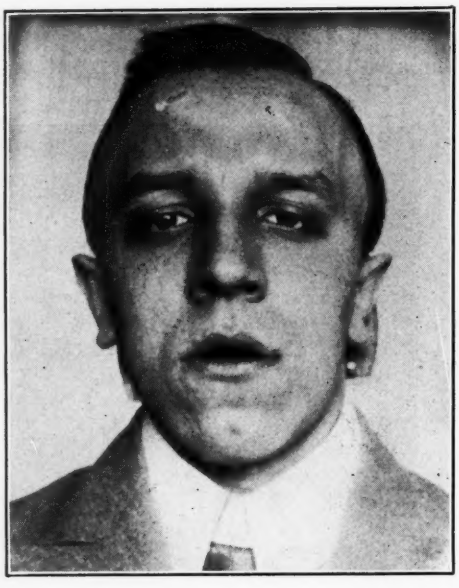

Fig. 18.

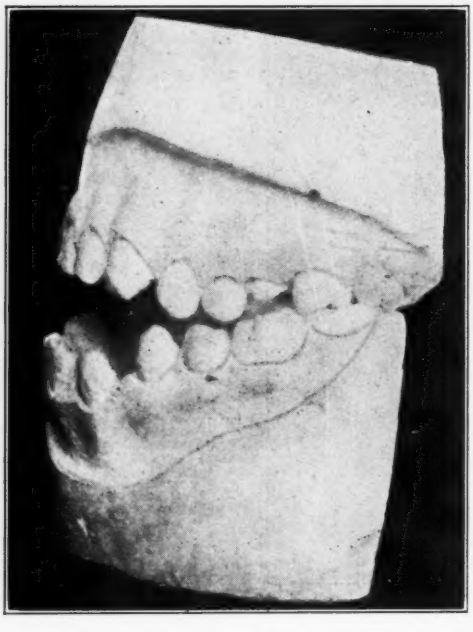

Fig. 19.

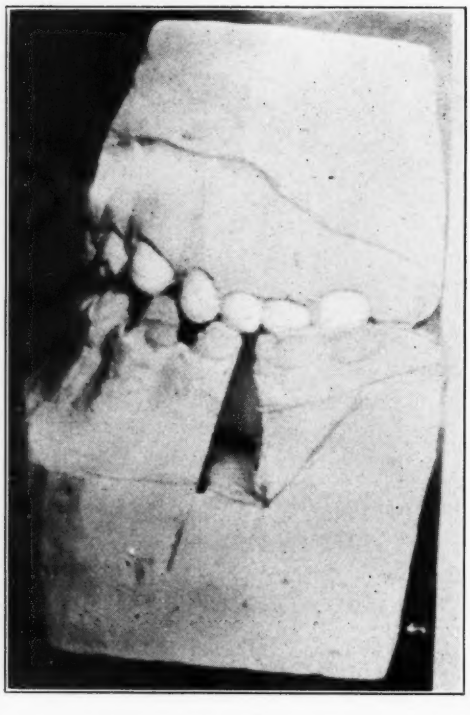

Fig. 20.

Figs. 17, 18, and 19 show a case of an extreme open-bite. Masticatory movements, language, and physiognomy are greatly impaired by this maxillary anomaly or by the impossibility to close the lips. The relation of the jaws and of the teeth will be seen on the plaster model. It appears that the upper jaw ascends very little in its curve and that the lower jaw in front is

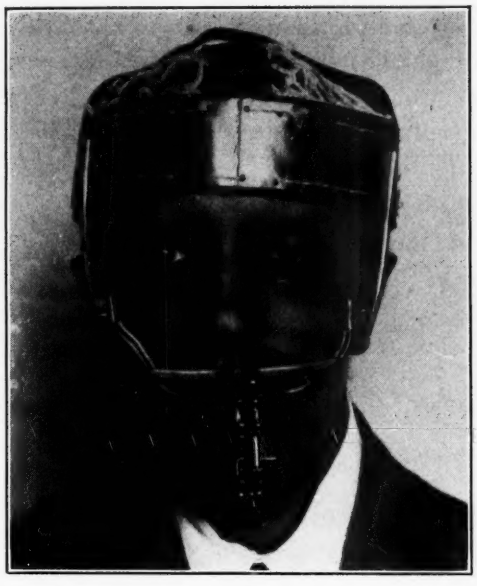

Fig. 21.

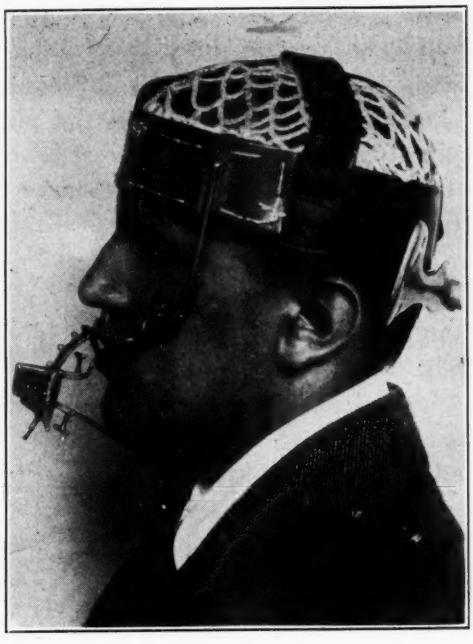

Fig. 22.

Fig. 23.

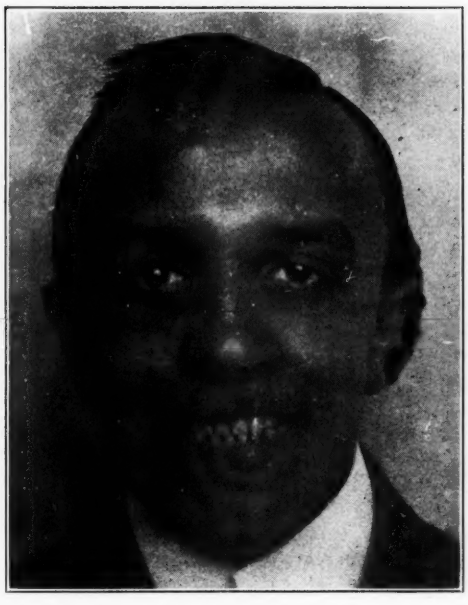

Fig. 24.

strongly curved downwards. As in the illustration of makrognathy the first bicuspid and the canine in the lower jaw are very remote from each other. When the bite is closed, only the second molars touch each other, while in front the teeth retire more and more. The largest space is about one inch in the median line.

This deformation is probably caused by an irregular growth of the skeleton, especially by rickets, and by disturbances of the internal secretory

glands. Other causes or accompanying symptoms are mouthbreathing, chronic pharyngitis, tonsillitis, and often adenoid proliferations.

The correction (Fig. 20) by excision of a cuneiform piece on both sides of the lower jaw is shown in the plaster model. Under anesthesia the corresponding pieces of the lower jaw were removed. Now the loose central portion of the lower jaw was seized by Bruhn's extension-forceps and fixed in the right position till after healing.

Fig. 22 gives the profile view of Bruhn's extension apparatus.

Fig. 23 shows normal lip-closing after the treatment. The nearly right articulation which was perfected later on by orthodontic treatment is shown in Fig. 24.

Recapitulating we may say that in the Westdeutschen Kieferklinik in Düsseldorf these methods to remove progeny and open-bite were used in fourteen cases, makrognathy in eleven. We were in all cases entirely successful, without any restriction.

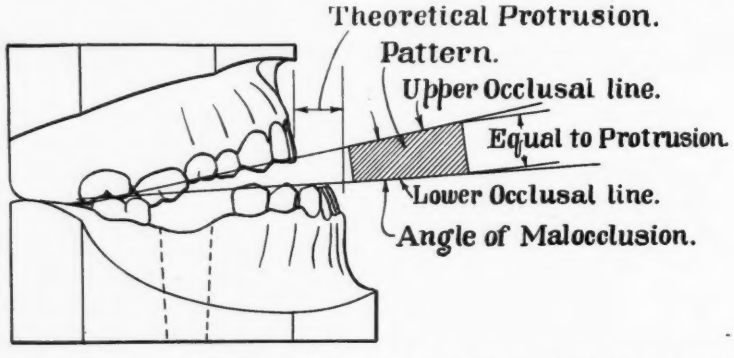

Fig. 1.—Formula for determining amount and angle of resection of lower jaw.

DISCUSSION

Dr. R. C. Willett.—In the presentation of the technic followed and results obtained in "the surgical-orthopedic removal of deformities of the jaws," a field of possibilities in the extension of orthodontic service is opened up,—not that we shall become oral surgeons, but that through closer cooperation, mutual study, and research, we can contribute to the relief of a human affliction that would be beyond the scope of either practice working alone.

I have been told by some orthodontists that where a surgical correction was involved, the orthodontist should leave the matter entirely to the oral surgeon's responsibility. Such a view is certainly narrow. It is right that the orthodontist should have high ideals and always keep in mind that picture of normal occlusion which represents the highest type of functional efficiency and preservation of the teeth, but considering the deficiencies of the human material we are frequently called upon to treat, some noticeable compromises must at times be made in our work. In every other branch of medical science, compromises are made, and neither can orthodontia be practiced in its broadest scope of benefit to humanity unless we frequently make compromises with our ideals in the treatment of many cases.

When patients have reached the early years of maturity, there are many cases in which orthodontic treatment would accomplish nothing. Where the deformity is pronounced, these cases are legitimate and proper cases for surgical interference. If the teeth are ever lost, it is impossible in many of these cases to make satisfactory artificial dentures for such mouths. We have seen both dispositions and nutrition radically influenced for good, and in the cases of women where the esthetic phase of the correction is a matter of importance to their peace of mind and social prestige, the resultant good cannot be overestimated.

Quoting from Blair, "The surgical treatment of deformities of the jaws should not be undertaken in any case without first having the fullest confidence of the patient, for during convalescence, trying complications may arise in which the surgeon will find his patience and his resources taxed to the limit. Operations on cases of moderate deformity should not be undertaken lightly, for the unforeseen accidents of surgery are always liable to occur."

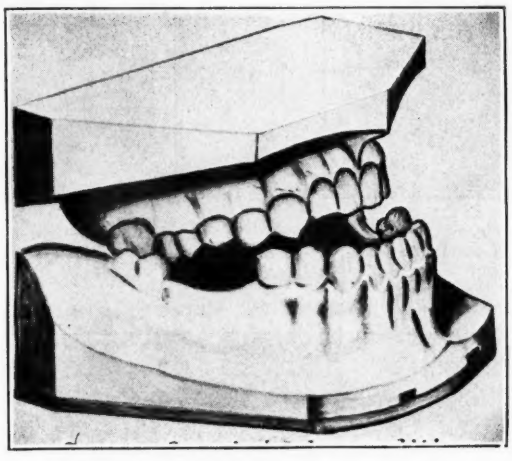

Fig. 2.—Cast of original condition, on metal track base.

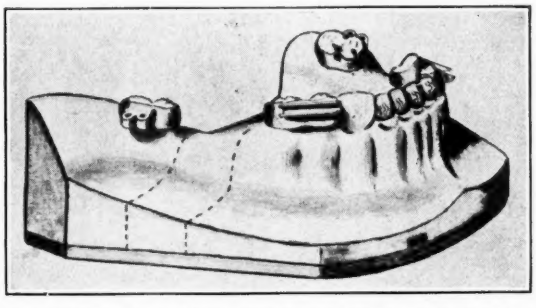

Fig. 3.—Cast with anchor bands as placed before operation.

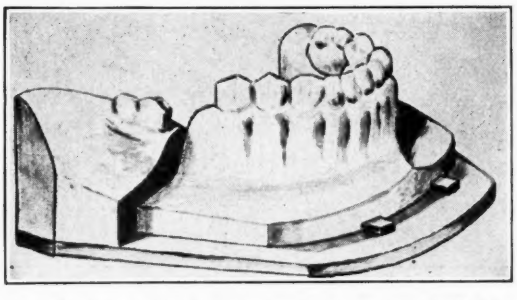

Fig. 4.—Cast, on track base, cut and resected 10 mm.

Dr. Bruhn seems to favor an operation on the mandible that does not involve the nerve and artery supply, but if the functional use of the teeth, and their occlusal relation is considered, as it should be in every case, the hazard of severing the artery and nerve dos not necessarily need to be considered. In deciding upon the area of the mandible best adapted for the resection, a careful study of the deformity should be made. An example of such a calculation, showing the most advisable area in which to operate, and the size and shape of segment to be removed, is shown in Fig. 1.

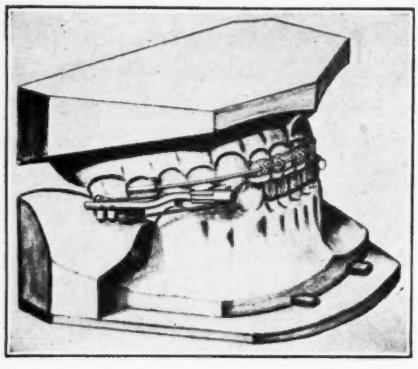

Fig. 5.—Upper and lower casts, showing appliances and jaws as ligated.

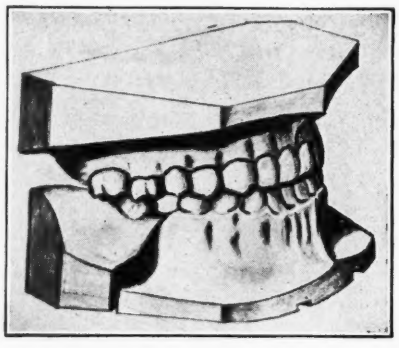

Fig. 6.—Showing adjustment made by bending truss to correct buccal relation of molar occlusion on right side.

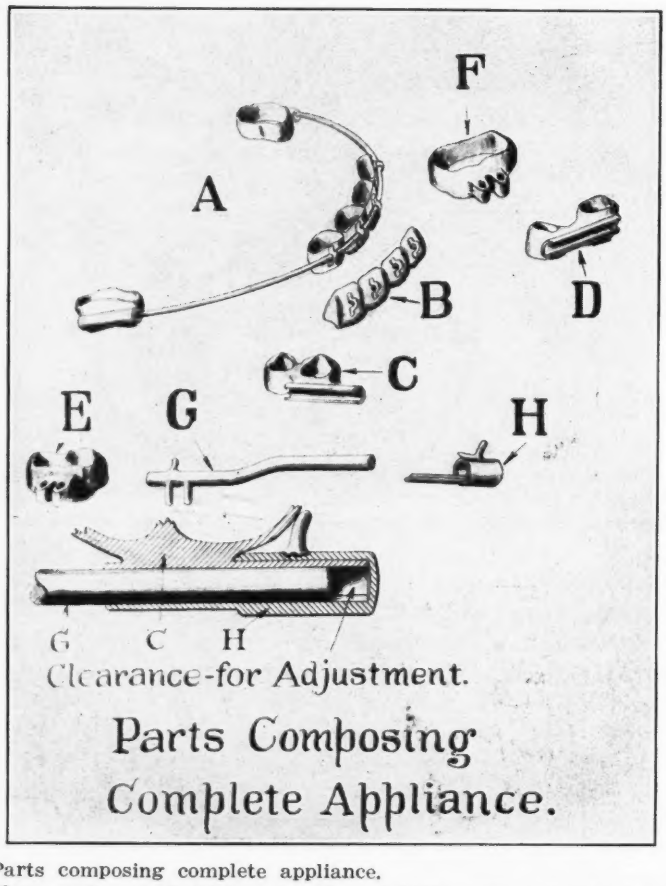

Fig. 7.—Parts composing complete appliance.

For maxillary arch. *a*, Labial arch wire (0.040") with assembled anchor bands and attachments.

For mandibular arch. *b*, Hard gold, one piece, cast overlay for incisors. Hooks on labial open to cervical. *c*, Right premolar bands (united) with open side buccal tube 0.057" bore. *d*, Left canine and first premolar bands (united). Buccal tubing the same as "*c*." *e* and *f*, Right and left molar bands with vertical buccal tubes 0.036" bore, *g*, Truss 0.055" with pins of 0.035" gauge and hold-down lug on distal end. One each for right and left sides to fit into vertical tubes on *e* and *f*. Mesial end to fit in buccal open tubing of *c* and *d*. *h*, Sleeve with hold-down lug and finger for truss. *g-c-h*, Assembled cross sectional view showing clearance, for adjustment.

In the construction of postmaintenance appliances, there are certain essential features to be considered according to the individual requirements of the case, and this is where the science of orthodontics can be applied.

1. In the selection of suitable materials, precious metal alloys are to be preferred, such as will not corrode, or in any way produce unhealthful conditions of the soft tissues.

2. The appliance should be so constructed that it can be removed in sections in case it should be advisable to retain one side in partial or complete fixation for a longer period than the other.

3. In view of a postoperative catastrophe, such as nausea, the fixation of the jaw should be made certain; and to this end, the rigidity of the assembled appliance, mounted upon resected plaster casts, should be thoroughly tested. With such an appliance for the mandibular arch, the ligating together of the jaws may be dispensed with until all danger of nausea or coughing has passed. Such an appliance is shown in Fig. 2. It has been used in the fixation of fragments, and proved to be practical. With an appliance of this kind, the surgeon will not find it necessary to bore holes in the bone fragments for placing wire or kangaroo ligature at the lower border of the jaw to aid in the immobilization as has been a common practice.

I trust that Dr. Bruhn will appreciate the fact that orthodontists are taking an interest in such surgical corrections as he has reported, and that they will welcome more reports from him along this line.

PERSONAL SERVICE DEPARTMENT

Conducted by Dr. H. C. Pollock, Dr. C. O. Simpson and Dr V. P Blair

December 15, 1926.

Dear Doctor Pollock:

I wish to appeal to your department in consideration of the problem of vertical overbite due probably to vertical development of the mandible, in the molar and premolar regions. Please direct me to literature proposed to correct this condition.

Opening the bite with bite blocks has not been successful. This method in cases between the ages of six and nine seems to depress the teeth blocked, and no vertical gain is obtained.

I will appreciate your consideration and attention, and will gladly give further information if I do not make myself clear.

Thanking you, I am,

Yours Truly,
J. F. D.

December 20, 1926.

Dear Doctor:

Answering your letter of December 15 regarding the vertical development of the mandible.

I am very glad to refer you to the following references which at least will give you access to several modern discussions of this subject and what I believe to be some of the more outstanding manuscripts which have been written on this particular subject under consideration during the last few years, and which have been published in the INTERNATIONAL JOURNAL OF ORTHODONTIA, ORAL SURGERY AND RADIOGRAPHY.

Robert Dunn, "Vertical Overbite," August, 1926.

J. Lowe Young, "Rational Treatment of Infra-Occlusion." December, 1923, volume ix, No. 12.

A. E. Rowlet. Same subject, September, 1923, volume ix, No. 9.

B. E. Lischer. Same subject. December, 1921, volume vii, No. 12.

Herbert Pullen. Same subject. Volume viii, No. 6.

If you have not access to the bound volumes or back copies of the above-mentioned journals I am sure that some of your neighbors in Iowa will be glad to lend you these references.

There is no doubt but that the question referred to in your letter is one of the most difficult problems to handle in the treatment of cases. However, I believe by carefully reading the above references you will secure the most modern thought on this subject.

With kind regards, I am,

Very sincerely yours,
H. C. P.

ABSTRACT OF CURRENT LITERATURE

Covering Such Subjects as

ORTHODONTIA — ORAL SURGERY — SURGICAL ORTHODONTIA — DENTAL RADIOGRAPHY

It is the purpose of this JOURNAL to review so far as possible the most important literature as it appears in English and Foreign periodicals and to present it in abstract form. Authors are requested to send abstracts or reprints of their papers to the publishers.

Paradentitis Marginalis. K. Häupl (Oslo), R. Neumann (Berlin). Zahnaerztliche Rundschau, October 24, 1926, xxxv, 43.

Häupl is at present engaged in a controversy with Professor R. Neumann on this subject and the present paper is a reply to one by Neumann in No. 32 of the Rundschau. Neumann in turn, having been allowed to see the article, makes a rejoinder in the same issue. The point in dispute is largely that of treatment, Häupl making use of the conservative Younger method while Neumann is an adherent of the radical procedure. The latter according to Neumann has cured hundreds of patients after they had submitted to the Younger method in vain. Neumann, by the way, prefers the term paradentosis to paradentitis on the authority of Weski. Häupl, on the other hand, states that his position corresponds to that of many of the most distinguished dentists in the various countries who seldom resort to radical operation. Neumann classes the two opposed groups of practitioners as theorists and practical men, respectively, in which the radical wing are made equivalent to the latter. This means apparently that Häupl and his allies bank too extensively on the laboratory, for while Häupl is fond of quoting general pathologists and dental histologists in large numbers as upholding his opinions, Neumann quotes hardly any authorities save perhaps a few operators. We get the impression that as a result of laboratory study Häupl feels justified in making a conservative operation although the end-results are found to be inferior. The advocates of the radical surgical procedure, on the other hand, are actuated solely by the desire to cure the patient radically by the shortest cut possible. Ordinarily one would expect a division of material into two classes with two different sets of indications, but we do not see the slightest tendency to compromise in the two articles.

Treatment of Möller's Glossitis. A. Treibel (Breslau). Zahnaerztliche Rundschau, November 7, 1926, xxxv, 45.

This condition is also known as chronic superficial glossitis and exfoliative glossodynia, and despite these names is not restricted to the tongue for it may also develop in the buccal mucosa. It has been independently discovered, first by Möller in 1851, then by Michelson in 1890, while in 1894 Josef

described it as an affection which occurs very largely in hypochondriacs mostly of the female sex. Its nature is thus far unknown. It first appears as a painful affection, without any apparent cause and even for a considerable time without anything to be seen. At a later period various lesions develop which show marked want of type—macules, streaks, papules, grouped at times in figures as V shapes and butterfly arrangements. The lesions show a tendency to reappear. The color varies, may be whitish or deep red, in the latter case the tongue looks raw. The patients worry over the possibility of cancer but no case of cancerous degeneration has yet been put on record. The name exfoliative glossodynia was given it by Kaposi, the dermatologist who contrasted the severity of the pain with the slight character of the lesions. The author reports two cases, one of which finally subsided under lactic acid applications, while the other left while still under the same treatment and the result is therefore unknown. The prognosis has always been considered very unfavorable for recovery.

Residual Alveolar Infection After Tooth Extraction. R. L. Haden and C. W. Keeling (Kansas City). The Dental Cosmos, November, 1926, lxviii, 11.

After quoting from reports of others on this and allied subjects, the authors give some results of original investigation in the Diener Institute. They have studied radiograms from numerous toothless jaws and for four years past have made bacteriologic studies of periapical foci, root tips and residual areas. The radiologic and cultural results were then compared. Two hundred edentulous jaws from 155 patients were examined comprising 3200 tooth areas, 86 root fragments, 75 residual areas, etc. Cultures from the 75 residual areas showed many positive results and many radiograms were considered positive, although there was not much parallelism in the two sets of figures. The same general result was obtained in connection with root fragments. Summed up, nearly one-half of the patients examined showed some anomaly. The authors evidently selected edentulous jaws because they are much more apt to be sterile than partly edentulous mouths. Thus only about one tooth area in 30 showed signs of infection either in radiograms or cultures. The tooth fragments showed a higher per cent of infection than the tooth areas. Clinical findings check up well with those of the laboratory. It seems safe to say that residual infection is quite common after tooth extraction.

Injury to the Jaws and Teeth from Roentgen Rays. M. Leist (Vienna). Correspondenz-Blatt für Zahnaerzte, October, 1926, l, No. 10.

Incidentally the author also takes up damage from the use of radium in the mouth but this subject has much less interest for the dentist. In general, however, the two forms of injury may be considered jointly. The author's paper is chiefly histologic and his summary is in part as follows: The ill effects of radiation are felt on the odontoblasts first and the odontoblasts of the germinal zone of the growing teeth are especially sensitive. The author was in fact able to arrest the growth of growing teeth in the dog, the teeth

later falling out. To make possible the shedding of the teeth the rays must injure the periodontium, bone and bone marrow. The pulp cells also participate in the injury. In the clinic, to determine whether the radiations have injured the vitality of the pulp the usual electric test for vitality may be used, although if the test is positive, that is, if the tested tooth is living, this does not exclude the possibility of pulp injury. Cases are sometimes reported of injury of the alveolar bone by roentgen rays or radium but these are always late injuries, due to too large doses or to cross radiation, the injuries being of a cumulative character. There is no suggestion in the paper of any possible injury from ordinary diagnostic radiography.

The Prevalence of Fuso-Spirillosis. Editorial in The Pacific Dental Gazette, November, 1926, xxxiv, 11.

The editor distinguishes carefully between the acute type of the Vincent symbiosis—known during the war as trench mouth—and the chronic form. The first-named is rare in comparison with the second, which is widely prevalent and always associated with periodontoclasia. The existence of these two distinct clinical types is confusing for in text- and reference books it is usually the acute disease which is described. The relation between the two is manifest for the acute can pass into the chronic phase and the latter can develop acute exacerbations. But the description of the acute process in the textbooks could not be recognized when one is confronted with an ordinary chronic case. The main criterion of the latter is the presence of the two microorganisms, for the clinical picture of the chronic form may present wide variations and without the criterion the diagnosis would be one of several affections—chronic gingivitis, pyorrhea alveolaris, phlegmonous third molar eruption and even the malignant affection known as noma. Moreover there are many forms of mixed infection in which the Vincent organisms are in association with ordinary pyogenic cocci in which we may find the local and general phenomena of sepsis. In certain cases the Vincent organisms are present at first in small numbers but in the presence of the pyogenics they multiply rapidly and assume intense virulence; so that clinically we see an example of acute fusospirillosis with or without mixed infection. This makes the presence of the Vincent organisms a menace in diseases of the mouth—the editor calls such a condition "potential fusospirillosis." To meet it, there should be routine bacteriologic examination especially in chronic gingivitis and proper bactericidal treatment.

Remineralization Through the Saliva. M. Kulka (Vienna). Zahnaerztliche Rundschau, October 31, 1926, xxxv, 44.

The author mentions the hypothesis that remineralization of the teeth is possible through the calcium of the saliva and states that credit is usually given to an American, Joseph Head, for advancing this view. The author, however, preceded him in this respect by two years, his article appearing in the Oesterreiche Zeitschrift für Stomatologie, 1908, No. 3. In this article he claimed that a portion of the surface of the enamel is transformed into sec-

ondary calcium phosphate. The calcium of the saliva is in the form of carbonate. If through acid mouth or saliva some of the calcium is withdrawn from the enamel the loss can be made good through alkaline saliva, in which medium the carbonate is changed to the phosphate of calcium. If this view is sound the damage done by acid mouth can be made good merely by changing the reaction of the saliva, which not only puts a stop to the deleterious action of the acid but restores the deficit. Why is it that a substance so unstable chemically as the enamel can nevertheless be so resistant? This remineralization from the saliva would explain it crudely. The author admits that a rigid demonstration including experimental research will have to be forthcoming before his view can be upheld or exploded. In the meantime the slogan of "healthy saliva protects the enamel," although only based on hypothesis, is a reasonable one and gives a basis for treatment.

New Research on Dental Caries. P. R. Howe (Boston). The Dental Cosmos, November, 1926, lxviii, No. 11.

The incidence of caries is from 95 to 98 per cent and a survey of the dental work of the past forty or fifty years shows that science has made no progress against it. The fermentive theory is apparently wrong in theory and practice. Sour feeders among man and the animals seem to have superior teeth. The author's research is entirely along histologic lines with the main aim of testing the permeability of dentin and its metabolism. This substance remains under the control of the odontoblasts throughout life and secondary dentin formation constitutes an important defense in caries, pulp retraction, attrition, etc. It is conceded by all that the dentin tubules are processes of the odontoblasts. Several recent workers seem to have placed it beyond doubt that there is a circulation in dentin which makes it possible for lime to be reabsorbed and injurious matter deposited. In lead poisoning lead may reach and be deposited in the dentin and the author has found that coloring matters fed to rats can stain the dentin from within. From analogy a good working hypothesis would be somewhat as follows: when for any reason, as pregnancy, lime is withdrawn from the dentin some deleterious substance probably is deposited in its place. In some conditions the organic substance of the dentin rather than the calcium may suffer, as in scurvy. The author does not go so far as yet to suggest the nature of the pathogenic substance deposited in the dentin nor does he outline any plan of treatment based on this theory.

The International Journal of Orthodontia, Oral Surgery and Radiography

PUBLISHED THE FIFTEENTH OF EVERY MONTH BY

THE C. V. MOSBY CO., 3523-25 Pine Blvd., St. Louis, Mo.

Foreign Depots — *Great Britain* — Henry Kimpton, 263 High Holborn, London, W. C.; *Australasia*—Stirling & Co., 317 Collins Street, Modern Chambers, Melbourne; *India*—"Practical Medicine," Egerton Street, Delhi; *Porto Rico*—Pedro C. Timothee, Rafael Cordero 68, San Juan, P. R.

Subscription Rates—Single copies, 75 cents. To anywhere in United States, Cuba, Porto Rico, Canal Zone, Mexico, Hawaii and Philippine Islands, $7.00 per year in advance. Under foreign postage, $7.40. Volume begins with January and ends with December of each year.

Remittances—Remittances for subscriptions should be made by check, draft, postoffice or express money order, or registered letter payable to the publishers, The C. V. Mosby Company.

Contributions—The editor will be pleased to consider the publication of original communications of merit on orthodontic and allied subjects, which must be contributed solely to this Journal.

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Entered at the Post Office at St. Louis, Mo., as Second-Class Matter.

EDITORIALS

Twelve Years Old Going on Thirteen

ELBERT HUBBARD had a style and charm of writing that was all his own. When the *Lusitania* sailed away and never came back, the literary world lost in Hubbard, one of its brightest stars. In his writings when a child was being described or when child life took any part, he usually commented on its age as ten years old going on eleven or fifteen going on sixteen.

With this issue, the INTERNATIONAL JOURNAL OF ORTHODONTIA, ORAL SURGERY AND RADIOGRAPHY passes into its teen age. It is twelve going on thirteen. Much water has passed over the dam during these dozen years. Dentistry, of which orthodontics is a part, has, during this period, thrown off the grave clothes and shroud. It has been resurrected, and in its resurrection, it is blessing and benefiting mankind.

It is not often that the pioneers in a science live to see the child of their dreams grown into hearty manhood—but orthodontics is an exception. Most of those who fanned the flame of its flickering life are alive today to see and enjoy its growth and development. Only Case has gone.

Momentous happenings have occurred since the first issue of the INTERNATIONAL JOURNAL OF ORTHODONTIA, ORAL SURGERY AND RADIOGRAPHY was given birth on the inky bosom of a Miehle press in January, 1915. Since that time the map of the world has been changed. Labor can no longer complain that a crown of thorns is being pressed upon its brow. Many diseases that for centuries have killed and cursed mankind have been conquered. Dentistry itself has been lifted from the Slough of Despond to a place of prominence and power among the learned professions.

Possibly in no age or in any clime has there been so great a change in the educational requirements for entrance to a profession as has taken place in dentistry during the past twelve years. Well do I remember the first meeting that I attended of the Institute of Dental Pedagogics in Ann Arbor in February of 1915. At that time the jingle of the pennies was the only requirement needed to take up the study of dentistry in almost any dental school. A man over fifteen and under sixty could be tamping ties on a railroad today and a dental student tomorrow, and almost all who entered a school graduated from it.

I shall never forget a conversation I had with a dean during the week this meeting was held. We were sitting in the lobby of the Allanel Hotel. Turning to me, he said, "Mosby, it's all tommy-rot, this talking about higher education for dentists. They are nothing but mechanics and never will be anything else. Over at my school, we are making good plumbers out of our students. That's all." Today, a five-year course with rigid entrance requirements is in force in that school.

A chat I had at that meeting with the dean of another school amuses me even to this day when I think about it. While smoking his panetela he told me about some of the troubles that beset him as a dean. "My greatest difficulty," said he, "is keeping the deans of other schools from stealing my students. Do you know," said he, "it's like keeping good horses in the west in pioneer days and protecting them against rustlers, to keep your students from being stolen by other schools." He then told me how the country had been divided up into various sections by the deans of the numerous dental schools that were then flourishing so that the students from those sections could be allocated to the schools located in them.

It certainly is to laugh when one looks back on dental education in those days and compares it with present-day education in dental universities. One heaves a sigh of relief over the change and compliments himself that a new era has been ushered in.

Possibly in no department of dentistry have more important changes taken place than in orthodontics during the past twelve years. From a specialty known and practiced by only a few, it has grown, until today, literally thousands of dentists and hundreds of specialists are treating orthodontic cases. The advance of this specialty within its own ranks has been

as noticeable as its development as a specialty in dentistry. Not many years ago an orthodontist was a mechanic and worked with things mechanical. Like a lineman employed by the American Telegraph and Telephone Co., he tackled his case with a roll of wire and a pair of pliers. Through the band and the expansion arch all of his work was done. Not so today. An orthodontist of this day and age is a scientist first and a mechanic afterwards. In diseases of the ductless glands he sees an etiologic factor that produces malocclusions. In an unbalanced diet, both in child life and on the part of the mother during pregnancy, he sees a reason for faulty dentition. He knows that during pregnancy the calcium content of the blood almost disappears because of the demand of the developing fetal skeleton, and he knows that unless this mineral in the blood is sufficient to meet both the demands of the mother and the child during fetal life, they both suffer.

Today the well-trained orthodontist is a scientist as well as a good mechanic. He is a physiologist, a physiologic chemist, a bloodless surgeon, a dietitian, and a skilled mechanic. He is broad-minded. He realizes that the world is big and that society needs fifty orthodontists to every one now engaged in this specialty. The narrow, bigoted specialist in orthodontics with his air of aristocracy and holier-than-thou attitude is gone.

It has been a pleasure to see this development—this evolution and progress during the past twelve years—and possibly to have been a factor in bringing it about. No more loyal and sincere friends could have been made than have grown up all around us in orthodontic circles during the time we have been publishing this Journal. This friendship has been a benediction and a blessing. It transcends all price in value.

—*C. V. M.*

ORTHODONTIC NEWS AND NOTES

Round Table Discussion—American Society of Orthodontists

For the meeting of the American Society of Orthodontists, which is to be held in Chicago, the Board of Censors have arranged a round table discussion to be held from 12:15 to 2 o'clock on May 4th at the Edgewater Beach Hotel. This plan is one that is entirely new in the American Society of Orthodontists; it is patterned after a similar program which is followed by the Specialty Society of Periodontists.

This discussion will be held at a luncheon. Each table seating eight or ten persons will be in charge of a discussion leader who will direct the informal discussion of the topic assigned to his group. The results of the discussion will then be reported by the chairman at the close of the luncheon. Subsequent to the luncheon the leader of each table will make a formal report giving his opinion of the reaction and trend of thought exemplified and brought out in the informal discussion at each table.

A list of subjects assigned, along with the names of the leaders of the various luncheon tables as outlined above, will subsequently be published in the columns of the INTERNATIONAL JOURNAL OF ORTHODONTIA, ORAL SURGERY, AND RADIOGRAPHY.

It is a further thought to institute this innovation and, in so far as practicable, bring about and direct a discussion of subjects in which there is a great deal of interest among orthodontists; subjects which are many times discussed formally but which are not often discussed informally. It is thought further that in informal discussion opinions are expressed more freely, a better understanding is possible of the true and honest trend of opinion upon many and varied subjects, which is sometimes difficult to bring to the surface in formal discussion on the floor of the meeting.

Service

With no obligation whatsoever the INTERNATIONAL JOURNAL OF ORTHODONTIA AND ORAL SURGERY is glad to provide information for the benefit of its subscribers and readers as follows:

Information as to available lists of Orthodontists practicing as a specialty throughout the world.

Lists of schools offering Postgraduate courses and instruction in Orthodontia in America and their locations.

Available lists of those practicing Oral Surgery as a Specialty.

Reference to any particular subject, or Department of Orthodontia, reference to any author which has appeared in the eleven years' files, and bound volumes of the INTERNATIONAL JOURNAL OF ORTHODONTIA AND ORAL SURGERY.

Please check information desired and mail to the International Journal of Orthodontia and Oral Surgery, 3523 Pine St., St. Louis, Mo.

Topics for Round Table Discussion at the Meeting of the American Society of Orthodontists

Up to the moment of going to press, the Round Table Discussion for the Meeting of the American Society of Orthodontists, to take place in Chicago, May 3, 4, 5 and 6, 1927, has been organized as follows. The discussions are listed according to the leaders of each group and the subjects which have been assigned to each table. Up to going to press, some leaders of table groups have not been heard from; accordingly their subjects remain unannounced until verification is received.

Dr. C. R. Baker, 708 Church Street, Evanston, Illinois.

"What is present status of the laboratory-made orthodontic appliance? Is it doing any service for the public or is it in the aggregate a failure? After all, the question is, Does it benefit the public? Can this question be discussed unbiased by orthodontists?"

Dr. Oscar Busby, Chairman, 1208 Medical Arts Building, Dallas, Texas.
Vice-Chairman, Dr. P. G. Spencer, Waco, Texas.

"On account of the constantly increasing demand for orthodontic service, should the general practitioner be encouraged to prepare himself to include orthodontic treatment in his practice?"

Dr. Frank Casto, 1336 B. F. Keith Building, Cleveland, Ohio.
Vice-Chairman, J. B. Mershon, Philadelphia, Pa.

"Is the present orthodontic training in dental schools adequate?

(a) Should the course of instruction be extended?

(b) Is the present course of instruction comprehensive enough for the student entering general practice?"

Dr. Willard Flint, 5113 Jenkins Arcade, Pittsburgh, Pa.

"From clinical experience and observation viewed from an entirely prac-

tical and unbiased standpoint, is there any particular outstanding factor which is responsible for the prevalence of malocclusion as observed in everyday practice; if so what is the practical and popular reaction to this question?''

Dr. Jacob Gorman, 629 Maison Blanche, New Orleans, La.

''So-called rapid treatment versus slow and conservative treatment. What is the present trend of opinion?''

Dr. Herbert C. Hopkins, Chairman, 826 Connecticut Avenue, Washington, D. C.
Vice-Chairman, Dr. Carlton M. Mott, 81 Patton Ave., Asheville, N. C.

''What is the prevailing opinion about the treatment of deciduous dentures, Class I, Class II, Class III, and the expansion of the deciduous mandibular and maxillary arches?''

Dr. Harry Hosmer, 1211 Stroh Building, Detroit, Michigan.

''Is the matter of prophylaxis in orthodontic treatment pretty generally neglected in your observation? Should the orthodontists stress this point and discuss it more in order to deliver better service?''

Dr. C. C. Howard, Doctors Building, Atlanta, Georgia.

''The present status of jaw and arch anomalies as correlated with body growth, with special reference to endocrine influences.''

Dr. Joseph E. Johnson, Suite 716 Starks Bldg., Louisville, Ky.
Vice-Chairman, Dr. Thad Morrison.

''Why do teeth decay under bands? What is the best method to prevent such decay? What are the advantages of direct and indirect methods of band making?''

Dr. A. H. Ketcham, Mack Block, Denver, Colo.
Vice-Chairman, J. Lowe Young.

''From an entirely practical standpoint and from observation in day to day practice, what is the present reaction to the possibilities of root absorption during orthodontic treatment?''

Dr. Charles A. Spahn, Chairman, 47 Central Ave., Newark, New Jersey.
Vice-Chairman, Dr. Lowrie J. Porter, 730 Fifth Ave., New York City.

''Discussion of Patient's Comfort During Orthodontic Treatment.''

Dr. Hugh Tanzey, Chairman, 508 Commerce Building, Kansas City, Mo.
Vice-Chairman, Dr. Wm. J. Brady, Kansas City, Mo.

''If the practice of orthodontia is a true science, what is the most feasible plan to extend the service it has to offer to the masses in a competent manner?''

Dr. Oliver W. White, Chairman, 406 Fine Arts Bldg., Detroit, Mich.
Vice-Chairman, Dr. Milton T. Watson, David Whitney Building, Detroit, Mich.

"What in your opinion is the best, most practical, and most satisfactory method from the standpoint of the patient alone, of handling cases one hundred miles or more remote from a skilled orthodontist?"

Dr. B. E. Lischer, Chairman, 4707 Westminster Pl., St. Louis, Mo.
Vice-Chairman, Dr. A. C. Rhode, 695 Astor Street, Milwaukee, Wis.

"Is progress in diagnosis desirable? Are intraoral occlusal diagnoses adequate and reliable? Are gnathostatic diagnostic procedures an improvement over occlusal methods?"

Dr. Wm. A. Murray, Chairman, Chicago, Ill.
"What Subjects and What Particular Type of Program Is the Most To Be Desired in Future Meetings of the American Society of Orthodontists?"

(NOTE: Dr. Murray's table will be known as the Utility or Emergency Table and those who have any conflicts in regard to what table they are to be assigned will please find seats at Dr. Murray's table, which group will be larger than those at the remainder of the tables.)

H. C. Pollock, Chairman Round Table Discussion,
4482 Washington Ave., St. Louis, Mo.

Southern Society of Orthodontists

The annual meeting of the Southern Society of Orthodontists will be held at Battery Park Hotel, Asheville, N. C., February 28, March 1 and 2, 1927. The preliminary announcement of the program is as follows:

Dr. B. E. Lischer, of St. Louis, and Dr. C. A. Hawley, of Washington, D. C., will give a joint paper on "The Simon Photostatic and Gnathostatic Instruments and Diagnosis."

Dr. Clarence O. Simpson, of St. Louis, will give a lecture and demonstration clinic showing the utility of the x-ray in orthodontic practice. The title of his paper is "The Advantages of Radiographic Examinations in Orthodontics, and Radiographic Technic."

Dr. Egon Neustadt, of Vienna, will give a paper on "The Growth of Bone in Relation to Function." This paper will be illustrated by a number of original microphotographs.

Dr. L. W. Elias, of Asheville, will give a paper on "Pediatrics in Relation to Orthodontics."

Dr. Briggs, a rhinologist of Asheville, will also give a paper, the subject of which has not yet been selected.

Dr. Martin Dewey, of New York, will give a lecture on the "Standardization of Appliances Used in the Treatment of Bilateral and Unilateral Posterior Occlusion Cases with Labial Version of the Maxillary Anterior Teeth."

Dr. Harry A. Holder, Pres.
Nashville, Tenn.

Dr. Oren A. Oliver, Sec'y,
Nashville, Tenn.

American Dental Golf Association

Another most interesting and enjoyable event which took place during the Seventh International Dental Congress in Philadelphia was the Seventh Annual Tournament of the American Dental Golf Association

The prizes and trophies were on display during the entire week of the Congress in the Commercial Museum. Here, also, forty-eight new members were received. On Sunday, August 22, preceding the Tournament, the Annual Calcutta Pool Dinner was held in the Pennsylvania Athletic Club. This occasion proved most successful—ninety taking part. The Play came off Friday, August 27, at the Manufacturer's Country Club. A most wonderful course and a beautiful day encouraged ninety-two golfers toward striving for the best scores. The winners were:

Dr. G. T. Gress, Pittsburgh, Pa., Champion.
Dr. Robt. N. LeCron, London, England, Runner Up
Dr. J. J. Hillsley, New York City, Handicap Winner.
Dr. Edward F. LaFitte, Philadelphia, Pa., Runner Up.

Class "A" Low Gross, Dr. A. M. Yessler, Woodstock, Ill.
Runner Up, Dr. E. W. Browning, Salt Lake City, Utah.
Low Net, Dr. Reinhard Nell, Philadelphia, Pa.
Runner Up, Dr. W. W. Powell, Philadelphia, Pa.

Class "B" Low Gross, Dr. A. J. Hefferman, Wilkes Barre, Pa.
Runner Up, Dr. Harvey Schwalm, London, England.
Low Net, Dr. A. E. Webster, Toronto, Canada.
Runner Up, Dr. A. L. Orr, Philadelphia, Pa.

Class "C" Low Gross, Dr. H. E. Beiser, New York City.
Runner Up, Dr. Frank J. Erbe, Waterbury, Conn.
Low Net, Dr. Harold R. Mead, Schenectady, N. Y.
Runner Up, Dr. A. L. Mulford, Philadelphia, Pa.

Dr. E. F. LaFitte, of Philadelphia, turned in the low gross score for morning play.

Dr. E. W. Browning, of Salt Lake City, had best gross score for afternoon play.

The following presented prizes and trophies:

The Williams Gold Refining Company, Buffalo, N. Y., Moving Picture Camera.

Oral Hygiene, Inc., Pittsburgh, Pa., Oral Hygiene Cup.

Lambert Pharmacal Co., St. Louis, Mo., Listerine Cup.

Eastern Dental Dealers, Philadelphia, Silver Cup.

Southern California Dental Golf Association, three prizes.

Heidbrink Co., Minneapolis, Minn., Mouth Props.

C. V. Mosby Co., St. Louis, Mo., "The Dentist's Own Book," by Kells.

Economy Golf Ball Co., New York City, One Dozen Golf Balls.

E. R. Squibbs & Sons, New York City, Cocktail Shaker.

August E. Drucker Co., San Francisco, Calif., Humidor.

Spyco Smelting & Refining Co., Minneapolis, Minn., Humidor.

Lavoris Chemical Co., Minneapolis, Minn., Golf Bag.

Dr. C. W. Roberts, London, Eng., one set clubs patterned from those of Bobby Jones, one set clubs patterned from those of Jesse Sweetzer.

A business meeting of the Association was held at noon of the day of the Tournament at which Dr. O. W. White of Detroit was elected Vice-President, Dr. Thos. P. Hinman of Atlanta re-elected Secretary-Treasurer and Dr. H. E. Kelsey of Baltimore, a director. Dr. Frank M. Casto, of Cleveland, concluded the second year of his three year term as President.

The 1927 Tournament will be played in Detroit. All announcements and arrangements will be published by the various dental publications and it is especially requested that all golfers or contemplating golfers keep on the lookout for them.

December Meeting of the Great Lakes Association of Orthodontists

The December Meeting of the Great Lakes Association of Orthodontists was held on Wednesday, December 8, at the Book-Cadillac Hotel, Detroit. Dr. Oren A. Oliver presented an interesting, illustrated paper and clinic on the construction and manipulation of the removable lingual appliance with auxiliary springs. He showed cases before and after treatment and also exhibited the appliances used in each case. The attendance was 85 per cent of the membership of the Society.

The Great Lakes Association of Orthodontists was organized by a group of men from Michigan, Northern Ohio and Canada who met at the Book-Cadillac Hotel in Detroit on November 2, 1926. The Society was sponsored by Drs. Milton T. Watson, O. W. White, George F. Burke, and F. W. MacDonald. These men represented the older practitioners of orthodontia in that community and have always been interested in the advancement of that science and the younger men. The next regular meeting will be held at the Book-Cadillac Hotel in Detroit on Wednesday, February 2, 1927. A very interesting program has been planned and an invitation is extended to all members of the orthodontic profession. The afternoon and evening will be given over to the program, and dinner will be served at six o'clock.

Missouri State Dental Association

The next meeting of the Missouri State Dental Association will be held at the Chase Hotel, St. Louis, Mo., May 23, 24, 25, and 26, 1927. Dr. E. H. Keys is chairman of the program committee and Dr. G. B. Winter is president of the association.

O. W. Brandhorst, Chairman Publicity Committee,
225 Lister Bldg., St. Louis, Mo.

Notes of Interest

Dr. W. Glenn Phillips announces that he will conduct a practice in orthodontia at Gardiner Building, Daytona Beach, Florida.

Dr. Landis H. Wirt, formerly of South Bend, Indiana, announces the removal of his office to 901 Congress Building, Miami, Florida. Practice limited to orthodontia.

Dr. Edward H. Bruening announces the opening of new offices in the City National Bank Building, Suite 620, Omaha, Nebraska.

DIRECTORY OF ORTHODONTIC SOCIETIES

The Eastern Association of Graduates of the Angle School of Orthodontia

Officers:

President, Dr. J. Lowe Young, New York City
Vice-President, Dr. George W. Grieve, Toronto, Canada
Secretary, Dr. E. Santley Butler, New York City
Treasurer, Dr. Walter S. Watson, New York City

Executive Committee:

Dr. Milo Hellman, Chairman
Dr. Herbert A. Pullen
Dr. Hugh K. Hatfield

Regular Meetings:

Saturday, January 29th, at Buffalo, N. Y.
Saturday, March 28th, at Boston, Mass.

Annual Meeting:

Monday and Tuesday, May 9th and 10th, at the Hotel Vanderbilt, New York City

Southern Society of Orthodontists

Officers:

President, Dr. Harry A. Holder, Nashville, Tenn.
President-Elect, Dr. Harry E. Kelsey, Baltimore, Md.
Secretary-Treas., Dr. Oren A. Oliver, Nashville, Tenn.

Meetings:

Monday, Tuesday, Wednesday, February 28th, March 1 and 2, 1927, at the Battery Park Hotel, Asheville, N. C.

The Great Lakes Association of Orthodontists

Officers:

President, Dr. Walter S. Sargeant, Toledo, Ohio
President-Elect, Dr. Earl H. Teetzel, Detroit, Mich.
Secretary-Treas., Dr. Ernest N. Bach, Toledo, Ohio

Board of Censors:

Dr. Harry L. Hosmer, Detroit, Mich.
Dr. James D. Locke, Grand Rapids, Mich.
Dr. Frank R. Woods, Detroit, Mich.

Meetings:

Regular meetings are the first Wednesday of November and the first Wednesday of February. The next regular meeting will be held at the Book-Cadillac Hotel, Detroit, Wednesday, February 2, 1927.

The American Society of Orthodontists

Officers:

President, Dr. Joseph D. Eby, New York City
President-Elect, Dr. Walter H. Ellis, Buffalo, N. Y.
Secretary-Treas., Dr. Charles R. Baker, Evanston, Ill.
Librarian, Dr. Abram Hoffman, Buffalo, N. Y.

Board of Censors:

Dr. Oren A. Oliver, Nashville, Tenn.
Dr. H. C. Pollock, St. Louis, Mo.
Dr. William E. Flesher, Oklahoma City, Okla.

Meetings:

Tuesday, Wednesday, Thursday, and Friday, May 3, 4, 5, 6, 1927, at Edgewater Beach Hotel, Chicago, Ill.

The Southwestern Society of Orthodontists

Officers:

President, Dr. W. T. Chapman, El Paso, Texas
President-Elect, Dr. O. H. McCarty, Tulsa, Okla.
Secretary-Treas., Dr. P. G. Spencer, Waco, Texas

Meetings:

November 2, 3, and 4, 1927, at El Paso, Texas.